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STATE DOCUMENTS

TRAFFIC SURVEY

BILLINGS

1954

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Aerial View of Central Business District

Carp's Photo

URBAN AREA TRAFFIC SURVEY
BILLINGS, MONTANA

CONDUCTED BY THE

MONTANA HIGHWAY COMMISSION

PLANNING SURVEY

AND

THE CITY OF BILLINGS

IN COOPERATION WITH

U.S. DEPARTMENT OF COMMERCE

BUREAU OF PUBLIC ROADS

1954

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OTIS S. WATERS, Member

SCOTT P. HART, State Highway Engineer
HENRY C. HELLAND, Assistant State Highway Engineer

Report Prepared By

PLANNING SURVEY

CHARLES S. KING, Planning Survey Engineer
PAUL R. DEVINE, Traffic Supervisor

In Cooperation With

U. S. DEPARTMENT OF COMMERCE

BUREAU OF PUBLIC ROADS

K. S. CHAMBERLAIN, District Engineer
JOHN R. SARGENT, Division Planning and Programming Engineer
R. M. ARENZ, District Planning and Programming Engineer

and the

CITY OF BILLINGS

EARLE KNIGHT, Mayor
STEWART W. NORTH, President of The Council
SAM B. WARD, City Engineer

TABLE OF CONTENTS

	PAGE
List of Plates	ii
Acknowledgements	iv
Foreword	v
Letter of Transmittal	vi
Definitions	vii
Survey Highlights	viii
Recommendations	1
Introduction	18
Part One -- Traffic Volumes	30
Part Two -- Inner Cordon Origin and Destination Survey	40
Part Three -- External Origin and Destination Survey	58
Part Four -- Parking Study	80
Part Five -- Urban Route Analyses	96
Part Six -- Speed and Delay Studies	106

LIST OF PLATES

PLATE NO.		PAGE
1	Proposed Improvements	12
2	Proposed Signing 2nd and 3rd Avenues North	13
3	Proposed Signing 28th Street	14
4	Proposed Signing 29th Street	15
5	Standard Signs -- One-Way Streets	16
6	Vicinity Map	24
7	Population and Motor Vehicle Trends	25
8	City Plat of Billings	26
9	Land Use Map	27
10	Hourly Traffic Volume Pattern	32
11	Daily and Peak Hour Traffic Volumes	33
12	Daily Variation and Hourly Percentage	34
13	Peak Hour Volumes and Design Hour	35
14	Traffic Flow Diagram	37
15	Map Showing Central Business District	42
16	Blank Zone Map of Billings	43
17	Passenger Car Trips to Central Business District	45
18	Truck Trips to Central Business District	47
19	Passenger Car Trips Through Central Business District	49
20	Truck Trips Through Central Business District	51
21	External Passenger Car Trips Through Central Business District	53
22	External Truck Trips Through Central Business District	55
23	Blank Zone Map of Billings	59
24	All Passenger Cars Passing Station 1	61
25	All Trucks Passing Station 1	63
26	All Passenger Cars Passing Station 2	65
27	All Trucks Passing Station 2	67
28	All Passenger Cars Passing Station 3	69

PLATE NO.		PAGE
29	All Trucks Passing Station 3	71
30	All Passenger Cars Passing Station 4	73
31	All Trucks Passing Station 4	75
32	All Through Traffic	77
33	Parking Capacity of Curbs, Lots, and Garages	85
34	Vehicles Entering or Leaving Cordon Area -- Average Weekday	86
35	Vehicles Entering or Leaving Cordon Area -- Average Saturday	87
36	Curb Space and Parking Lot Occupancy -- Friday	88
37	Curb Space and Parking Lot Occupancy -- Saturday	89
38	Parking Supply and Demand	90
39	Curb Parking Characteristics -- Block 525	91
40	Curb Parking Characteristics -- Block 530	92
41	Curb Parking Characteristics -- Block 531	93
42	Curb Parking Characteristics -- Block 542	94
43	Urban Route Analyses -- U.S. 10	99
44	Urban Route Analyses -- U.S. 10	100
45	Urban Route Analyses -- 27th Street	101
46	Urban Route Analyses -- 27th Street	102
47	Intersections Operating Above Traffic Capacity	103
48	U.S. 10 Speed and Delay -- Peak Hour	109
49	U.S. 10 Speed and Delay -- Off Peak Hour	110
50	U.S. 10 Speed and Delay -- Delay Analysis	111
51	27th Street Speed and Delay -- Peak Hour	112
52	27th Street Speed and Delay -- Off Peak Hour	113
53	27th Street Speed and Delay -- Delay Analysis	114
54	Proposed Signal Timing -- U.S. 10	115
55	Proposed Signal Timing -- 27th Street	116

A C K N O W L E D G E M E N T S

The successful completion of the Billings Urban Area Traffic Survey was made possible through the splendid cooperation of a great number of individuals and agencies.

We are especially grateful for the cooperation and assistance rendered by Mayor Knight and his staff, the Billings Gazette, and Radio Stations KOOK, KGHL, and KBMY.

Our appreciation is also extended to a number of Bureau of Public Roads Technicians and to Mr. R.E. Dunn, Assistant Traffic Engineer of the Washington Highway Department, whose assistance in a consulting capacity has been most valuable.

The following standard publications as well as a great number of other published reports by the Bureau of Public Roads and other State Highway Departments were used as references in the preparation of this report.

TRAFFIC ENGINEERING HANDBOOK, Second Edition, Henry K. Evans, Editor. A joint publication of the Institute of Traffic Engineers and the Association of Casualty and Surety Companies, New York, New York, 1950.

HIGHWAY CAPACITY MANUAL, prepared by the Committee of Highway Capacity, Department of Traffic and Operations, Highway Research Board, Washington, D. C., 1950.

PARKING STUDY MANUAL, Department of Commerce, Bureau of Public Roads, Revised Edition, 1953.

FOREWORD

The Billings Urban Area Traffic Survey was conducted during July and August of 1954 by the Montana Highway Commission Planning Survey in cooperation with the Bureau of Public Roads and the city of Billings.

A comprehensive origin and destination study was made of traffic crossing a cordon line enclosing the central business district as well as traffic entering and leaving the metropolitan area. In addition to the origin and destination surveys, a partial parking study was conducted to gain some knowledge as to how acute the parking situation has become in the central business district. Intersection capacity studies were made on all important intersections in the City and speed and delay studies were conducted on the major through routes.

After analyzing the vast amount of data collected during the survey, certain general recommendations have been formulated which should provide relief from some of the more obvious traffic problems in the metropolitan area. It is believed that the data presented in this report can also be applied to specific traffic situations as they arise in the future.

STATE OF MONTANA
HIGHWAY COMMISSION
HELENA

July 1, 1955

The Honorable Earle Knight, Mayor
and
Members of the City Council
Billings, Montana

Gentlemen:

It is a pleasure to present you with the report on the Billings Urban Area Traffic Survey, conducted during July and August, 1954, as a cooperative project with the Bureau of Public Roads and the City of Billings.

The factual data contained in the report and the recommendations based on these data are submitted in the hope that they will be of value in alleviating existing traffic congestion.

Your cooperation, and that of the other City Officials and employees, left nothing to be desired and made the work a real pleasure. Your progressive attitude toward the solution of these problems is very heartening to our entire department.

Please be assured that the interest of the Highway Commission in the solution of these problems will be a continuing one and we will cooperate in every possible manner in a program of correction.

Respectfully submitted

Scott P. Hart
State Highway Engineer

SPH:O

DEFINITIONS

ORIGIN AND DESTINATION STUDY. A study of the origins and destinations of trips made by vehicles passing out of, into, or through a selected area.

EXTERNAL ORIGIN AND DESTINATION STUDY. That part of an origin and destination study conducted usually by roadside interviews on main highways entering a certain area or city.

INTERNAL ORIGIN AND DESTINATION STUDY. That part of an origin and destination study usually conducted by interviewing motorists entering or leaving the central business district of a city.

CENTRAL BUSINESS DISTRICT. The major business district of a city, also commonly called the downtown area.

CORDON LINE. A line used to define and bound a certain area. In this study the area bounded by the cordon line was the central business district.

CORDON COUNT. A count of all vehicles entering and leaving a certain area (central business district) during a specified length of time.

TRAFFIC PATTERN. A tabular or graphical presentation of the fluctuation of traffic over a specified period of time.

TRIP. The one-way travel of one vehicle between an origin and destination.

DESIRE LINE. A straight line between a point of origin and a point of destination without regard to existing routes.

SPACE HOUR. One parking space used for one hour. A term used to measure parking supply and demand on a comparable basis.

PARKING DEMAND. Total need for parking space as determined by the expressed origins and destinations of drivers.

PEAK HOUR OF ACCUMULATION. The hour during which there is the maximum accumulation of vehicles within the survey area.

PARKING TURNOVER. The number of vehicles using one parking space during a specified length of time.

DESIGN VOLUME. A traffic volume determined for use in design representing traffic expected to use the facility. Unless otherwise stated, it is an hourly volume roughly corresponding to the 30th maximum hour for the year.

POSSIBLE CAPACITY. The maximum number of vehicles that can actually be accommodated by an intersection approach under prevailing conditions with a continual backlog of waiting vehicles.

PRACTICAL CAPACITY. The maximum number of vehicles that can enter an intersection from any approach with most of the drivers being able to clear the intersection without waiting for more than one complete signal cycle.

SURVEY HIGHLIGHTS

The average weekday traffic entering, leaving, and passing through Billings' central business district during July 1954 totaled 119,307 vehicles or 81,509 one-way trips between point of origin and point of destination.

Over 53,000 one-way trips or 65 per cent had either an origin or destination within the inner cordon or central business district. Approximately 35 per cent of the one-way trips could theoretically by-pass the central business district enroute to zones or points outside the downtown area.

The maximum accumulation of vehicles within the business district occurred between 10 and 11 A.M. on both weekdays and Saturday. On weekdays the accumulation of vehicles remains quite constant from 9 A.M. to 5 P.M. but on Saturdays it dropped quite sharply in the afternoon.

The peak hour of traffic occurred in the downtown area between 4:30 and 5:30 P.M. During this one hour 8.2 per cent of the average 24 hour weekday traffic crossed the cordon line near the central business district.

There were 3,285 parking spaces within the inner cordon area as of July 15, 1954. These spaces consisted of 872 at metered curb, 945 free curb, 306 in metered lots, 1103 in other parking lots and 59 in garages. During the peak hour of parking between 10 and 11 on Saturday morning all curb spaces were filled to 95 per cent of capacity. Off street parking lot spaces were filled to 58 per cent of capacity during the same hour. Twenty-one blocks in the central business district were found to have vehicles parked at the curb in excess of the legal spaces available.

The average length of time parked both curb and off street for work or business was 1 hour and 11 minutes, shopping 42 minutes, social or recreational 1 hour 27 minutes, medical 1 hour 4 minutes, and other purposes not listed 1 hour and 12 minutes. The average length of time parked for all purposes at both curb and off street was 1 hour 12 minutes.

In four representative blocks in the business district, 83 per cent of the vehicles parked at the curb for 1 hour or less and used 46 per cent of the available space hours. Only 17 per cent of the total number of vehicles parked at the curb for over 1 hour but they used 54 per cent of the total space hours available.

One municipally operated off street parking lot was found to be filled to only 26 per cent of capacity during the peak hour of parking.

Carter Oil Refinery -- Billings

Carter Oil Company Photo

RECOMMENDATIONS

ONE-WAY STREETS

Other sections of this report, covering various phases of the traffic survey, present factual data pointing to the need for improved facilities to carry the comparatively heavy volumes of traffic into and through the central business district of Billings. Various methods, such as street widening, the prohibition of curb parking, or one-way street operation, can be utilized to gain the necessary increased traffic carrying capacity of the existing streets. Of these methods, one-way street operation is by far the simplest and cheapest means of obtaining additional capacity, speed, and safety on an existing street system.

It is therefore recommended that 2nd and 3rd Avenues North be placed in one-way operation from Division to 22nd Street immediately and that this couplet be extended to 13th Street after the 4th Avenue North and 13th Street By-pass has been constructed. It is further recommended that 28th and 29th Streets be operated as a North - South one-way couplet between Poly Drive and Sixth Avenue South. Details of the proposed one-way couplets and recommended signing are shown on plates 1 - 5 inclusive.

The operation of 28th and 29th Streets as a one-way couplet will necessitate the widening of Poly Drive from 28th Street to Virginia Lane. This improvement can be accomplished without too much difficulty and will remove a definite traffic bottleneck on Poly Drive. It is recommended that this improvement be made as soon as it is practicable.

In order to obtain maximum efficiency from the North - South couplet, it is recommended that 29th Street be extended one block from 12th Avenue North to Poly Drive. This will require the acquisition of right-of-way through property now vacant and being utilized as an overflow hospital parking lot.

The extension of 29th Street will directly tap Poly Drive, one of the

more heavily traveled East - West arterials, and will provide a diagonal connection to 28th Street which will insure a smoother transition from one-way to two-way operation. It is believed that these two important advantages justify the acquisition of the necessary right-of-way.

One of the major disadvantages that will be encountered in the one-way operation of Poly Drive from 27th to 29th Streets will be the inconvenience to east bound traffic on Poly Drive desiring to turn left on 27th Street. This traffic will be forced to use either Rimrock Road to the north or 12th Avenue to the south of Poly Drive. Due to the restricted sight distance at the intersection of Rimrock Road and 27th Street, it is suggested that this turning movement be encouraged to use 12th Avenue North by prohibiting left turns from Rimrock Road. Signalization of the intersection of 12th Avenue and 27th Streets may become necessary in the future as traffic volumes increase.

After the proposed North - South couplet has been in use for a sufficient length of time to enable the motorists to become accustomed to its advantages, present traffic volumes on North 30th Street should drop to a point where it will not be necessary to operate this street as an arterial. It is therefore suggested that the traffic controls designating 30th Street as an arterial be removed and that 1st, 2nd, 3rd, 4th, and 6th Avenues North be given preferential treatment.

To properly regulate the traffic flow on the one-way street couplets, it will be necessary to install traffic signals at six intersections as shown on Plate 1. Signal timing should then be adjusted to provide uniform progression at 20 - 25 miles per hour. The traffic signals at Montana Avenue and 28th and 29th Streets will require installations to interconnect with the present railroad crossing warning system. In operation, these two signals should show a steady red north and south on 28th and 29th Streets and green on Montana Avenue when a train or switching operation approaches the crossings directly to the south. South bound traffic on 29th Street could be allowed

to turn right on Montana Avenue, when the crossing is blocked, by the addition of a turning arrow or an appropriate sign. The signalization of these two intersections is urgent regardless of one-way operation.

P A R K I N G

A parking survey in the downtown area of Billings indicates a critical situation exists in over one-third of the 45 block area within the inner cordon. During the peak hour of parking which occurred between 10 and 11 A.M. it was found that 21 blocks on Saturday and 14 blocks on Friday were filled to over legal capacity on curb parking. During this same hour the average curb space occupancy in the entire 45 block area was 95 per cent of capacity on Saturday and 90 per cent on Friday and the average lot occupancy was approximately 60 per cent of capacity on both days.

Parking data obtained in conjunction with the origin and destination survey indicates that parking demand exceeds supply in a 16 block area during the entire 8 hour period from 10 A.M. - 6 P.M. This same study also indicates that demand for all types of parking averages 76 per cent of the total available space hours in the entire 45 block area during business hours.

All of these factors point to the need for additional parking space and more efficient utilization of the parking spaces now available.

The city of Billings is to be commended for its foresighted policy in acquiring four off-street parking lots with a fifth under construction at the time of the survey. These lots are located on the fringe of the business district at walking distances varying from 950 feet - 1250 feet from the center of the downtown area. They were filled to an average of 35 per cent of capacity on Friday and 49 per cent of capacity on Saturday during the peak hours of parking.

It is believed that the 10 cent an hour rate for the entire 24 hours charged at three of the parking lots, compared with the 5 cents per hour

rate at the adjacent curb during business hours only, is discouraging maximum use of the municipal lots. Indicated proof of this condition is shown on Plate 38. Maximum demand for parking was found to be in the Hart-Albin Block located between 28th and 29th Streets and 2nd and 3rd Avenues North. Two municipally operated off-street parking lots with a total capacity of 171 spaces are located within one block of the heaviest parking demand. During the peak hour of parking on Saturday morning the largest lot, which has a capacity of 104 cars, was filled to only 26 per cent of capacity at the 10 cent per hour rate. The smaller lot, which is somewhat nearer to the center of the business district, was filled to 76 per cent of its 67 car capacity during the same hour. Spaces at the adjacent curb were completely filled in the block containing the 67 car lot and 85 per cent filled in the block containing the 104 car lot. It is therefore recommended that the curb and off-street meter rates be made directly competitive in order to induce a greater usage of the off-street lots. It is further recommended that a maximum time limit of 4 or 5 hours be established in the off-street lots after the rates have been adjusted.

An inventory of the parking facilities in the business district revealed that there were a total of 872 curb parking meters in use as of July 1954. Of this total 540 were of the two hour type. Inasmuch as the average time parked at the curb for all purposes was found to be 48 minutes, it is recommended that the two-hour meters on Montana, 1st and 2nd Avenues North be converted to one hour operation. This step, in connection with adequate enforcement, should increase the curb parking turnover considerably.

In the nine block core area outlined on Plate 38 the estimated parking demand exceeds the available supply by approximately 2600 space hours between 10 A.M. and 6 P.M. This excess demand will require an additional 330 parking spaces in or adjacent to the core area to satisfy immediate needs. In a city the size of Billings any new parking facility preferably should be located within a maximum walking distance of 450 to 500 feet from the principal

business frontage.

It must be emphasized that the estimated 330 additional parking spaces will only satisfy immediate needs. Since it is estimated that vehicle registrations will have increased by at least 30 per cent by 1964, any long range parking program will have to take this increase into consideration.

ISOLATED INTERSECTION TREATMENT

Montana Avenue and 27th Street

This unsignalized intersection was one of the sites of the highest number of accidents in the City during the period of June 30, 1953 to July 1, 1954. Nineteen accidents involving property damage only and three accidents involving both property damage and injuries were reported to the police department during the year. Twelve accidents of the right angle type and two accidents involving pedestrians should have been prevented if the intersection had been signalized.

Traffic volumes entering the intersection during the peak hour were recorded as 611 vehicles on Montana Avenue and 368 vehicles on 27th Street and averaged well above the minimum warrants for signalization for the 8 hour period between 10 A.M. and 6 P.M.

The location of this intersection in relation to the Northern Pacific Railroad tracks will require the interconnecting of the proposed traffic signal with the present railroad crossing signals. This will mean a more complicated and consequently a more expensive installation than on the average street. In spite of the relatively high costs, it is recommended that this intersection be signalized as quickly as funds are available.

First Avenue North and 32nd Street

This intersection also had 22 accidents during the period of June 30, 1953 to July 1, 1954. In analysing the collision diagram, it was found that fourteen accidents or 64 per cent were rear end collisions on First Avenue

North and that nine of the fourteen occurred on the west approach of First Avenue North. As all but two of the rear end collisions occurred during daylight hours in good weather, the pattern suggests excessive speeds entering the intersection on the west approach and an amber period too short to allow approaching vehicles to clear the intersection. A spot speed check made on First Avenue North just west of 32nd Street bears out these conclusions. Maximum recorded speed of east bound traffic was 35 miles per hour with 29 per cent of all vehicles exceeding the posted speed limit of 25 miles per hour. It is suggested that a concentrated campaign to reduce speeds between Division and 32nd Streets might reduce the number of rear end collisions at this location. Advance warning signs of *signals ahead* and a longer amber interval on the signal might also help in preventing this type of accident.

6th Avenue North and 27th Streets

This intersection of two major streets was the scene of 21 accidents during the period of June 30, 1953 to July 1, 1954. Inasmuch as these accidents do not follow any set pattern they can be attributed to the general congestion resulting from overloading the intersection. During the peak hour in August, the south approach was operating at about 17 per cent above practical traffic capacity and the other three approaches were rapidly becoming overloaded. This condition is considered the primary cause of the high accident experience. The operation of 28th and 29th Streets as a one-way couplet and the construction of the proposed truck by-pass between the Lavina cut-off and U.S. 10 East should divert a sufficient amount of traffic from 27th Street to insure a more orderly flow of traffic through this intersection.

First Avenue North and 13th Street

The intersection of these two major streets is not signalized and present

traffic volumes definitely exceed the minimum warrants established for signalization. The installation of signals has been approved by the State Highway Commission and plans are now being formulated to contract this project. This should improve the traffic flow through the intersection and provide better access to the South Side By-pass through the 13th Street underpass.

ARTERIAL STREETS

To facilitate the orderly movement of traffic in the newer subdivisions to the west of the original townsite of Billings, it is essential that a plan for arterial streets be adopted and followed by the City Administration. Approved practice recommends that major arterials be spaced at about 2,000 feet apart for the most efficient operation. This general criterion has been met quite satisfactorily for East - West arterials but it is suggested that at least two additional streets be placed in arterial operation from North to South.

Eighth Street West is now carrying traffic volumes justifying arterial operation and it is located approximately 2,000 feet west of 5th Street West, the nearest North - South arterial. It is therefore recommended that 8th Street West be placed in arterial operation from Central Avenue to Parkhill Drive as soon as funds are available for the necessary traffic controls. Preferential treatment should be accorded 8th Street West at all intersections with the exception of Central, Broadwater, and Grand Avenues and Parkhill Drive. Traffic volumes at the intersections of 8th Street West and Broadwater and Grand Avenues are approaching the minimum warrants for signalization and it is anticipated that signals will be required in the near future.

As the city develops to the west it will become necessary to designate at least one more North - South arterial in the vicinity of Meridian Street. If this street is selected, plans should now be made to extend it to the south from Grand to Central Avenues.

BY - PASS ROUTES

Billings is now provided with an adequate East - West by-pass on the south side of the Northern Pacific Railroad which expedites the flow of through traffic. Plans are now being made by the Montana Highway Commission for the improvement of 4th Avenue North and 13th Street as a truck route. This contemplated improvement will provide a more direct route to the industrial districts for trucks entering and leaving the City on U.S. 10 East and should reduce the demand for left turning movements at the intersection of First Avenue North and 13th Street by about 60 per cent.

Trucks using F.A.S. 301, the Billings - Lavina cutoff, are now forced to enter or leave the City on 27th Street. This entrance requires them to negotiate a 7½ per cent grade between the airport and Poly Drive and takes them through the congested downtown area. Plans have been formulated for a by-pass route intersecting F.A.S. 301 near the airport and continuing easterly on the crest of the Rimrocks to an intersection with U.S. 10 just northeast of the city. It is estimated that this route will divert 150 medium and heavy trucks per day in addition to the 385 passenger cars and light trucks that the unimproved present traveled way is now carrying.

Both of these proposed projects warrant immediate construction and it is contemplated that they will be let to contract in the near future.

MONTANA AVENUE UNDERPASS

This obsolete structure is located near the west city limits of Billings on U.S. 10, Montana's heaviest traveled route. The two 14 foot traffic lanes divided by a center pier are badly overloaded by traffic volumes of over 9,000 vehicles per day. In view of the heavy traffic volume now using the present obsolete underpass it is recommended that this structure be replaced as quickly as possible with an overpass, adequately designed to handle present and future traffic volumes.

LONG RANGE PROGRAM

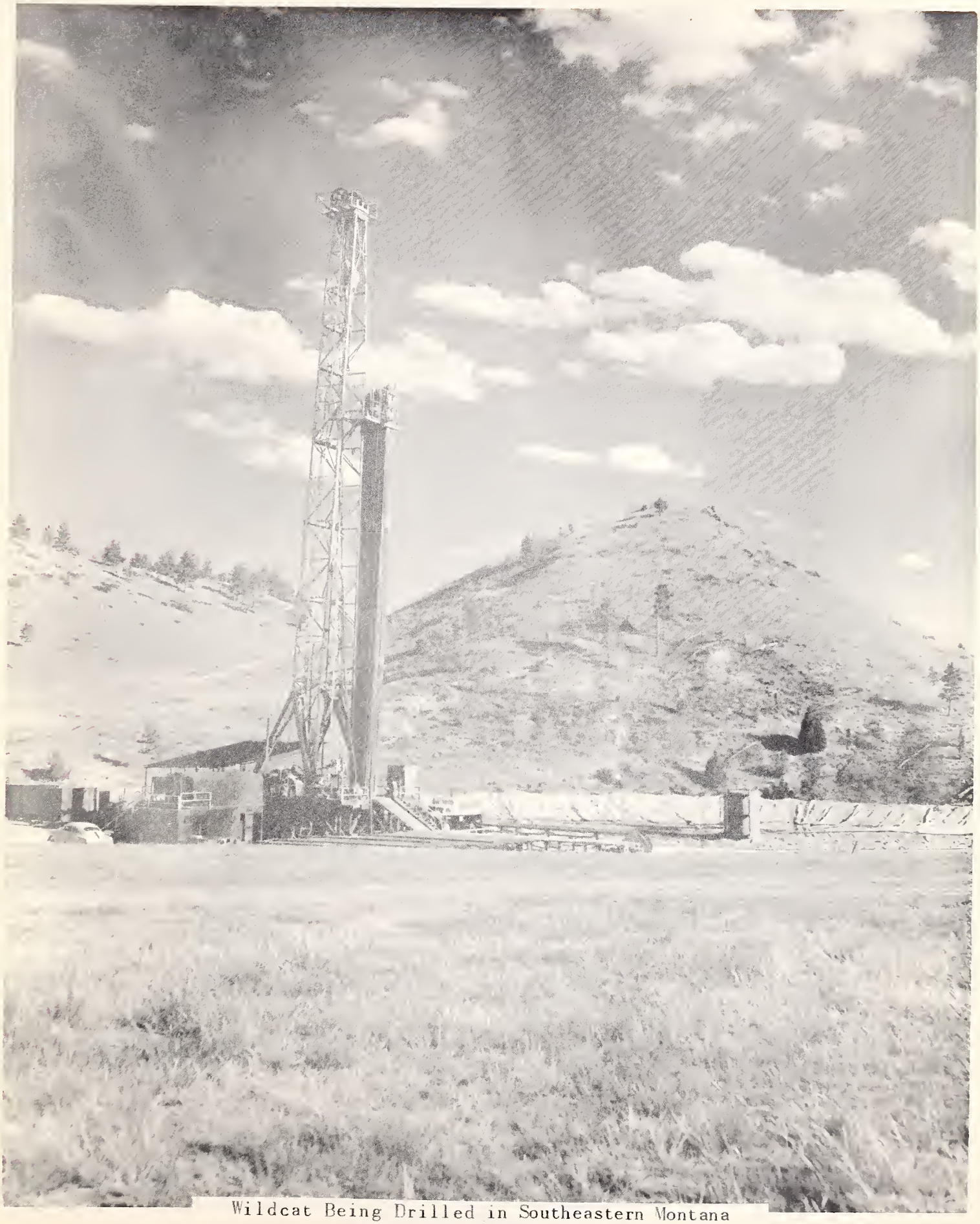
If Billings is to continue to develop primarily to the west as it has done the past few years, consideration should be given to investing the present City-County Planning Board with sufficient powers to insure the orderly development of future subdivisions now outside the city limits. This board should develop definite standards for various classes of streets and should be responsible for the extension of present arterials to serve the new areas. In this manner many of the present narrow street widths and jogs from one subdivision to another could be avoided.

Broadwater Avenue, one of the more important East - West arterials is fast approaching practical traffic capacity on the section from Division Street to 5th Street West. The east leg of the intersection with 5th Street West is now operating about 20 per cent above practical traffic capacity, during the peak hour of 4:30 - 5:30 P.M. The present 40 feet width of this arterial is now carrying traffic volumes of over 800 vehicles during the peak hour and it is anticipated that these volumes will have increased by at least 30 per cent during the next 10 years. In order to adequately provide for these anticipated volumes it probably will be necessary to institute a one-way street couplet in this area between Division and 8th Street West within the next few years.

The section of U.S. 10 and First Avenue North between 13th Street and the junction with U.S. 87 was found to be carrying a traffic volume of approximately 13,000 vehicles per day during August of 1954. The two lanes of the existing roadway are badly overloaded at the present time and it is estimated that traffic volumes on this section will still warrant four-lane construction after the 4th Avenue North and 13th Street By-pass is constructed. Plans for this project now are being made by the Montana Highway Commission.

The future location of the Interstate Routes in the Billings area has not been decided definitely but the final location no doubt will have a considerable influence on the existing traffic patterns within the City.

The external origin and destination survey indicates that approximately 19 per cent of the total traffic entering or leaving Billings on U.S. 10 did not wish to stop in the City. On this basis at least 1,000 passenger cars and light trucks and 250 medium and heavy trucks per day could use a high type facility near the perimeter of the urban area.

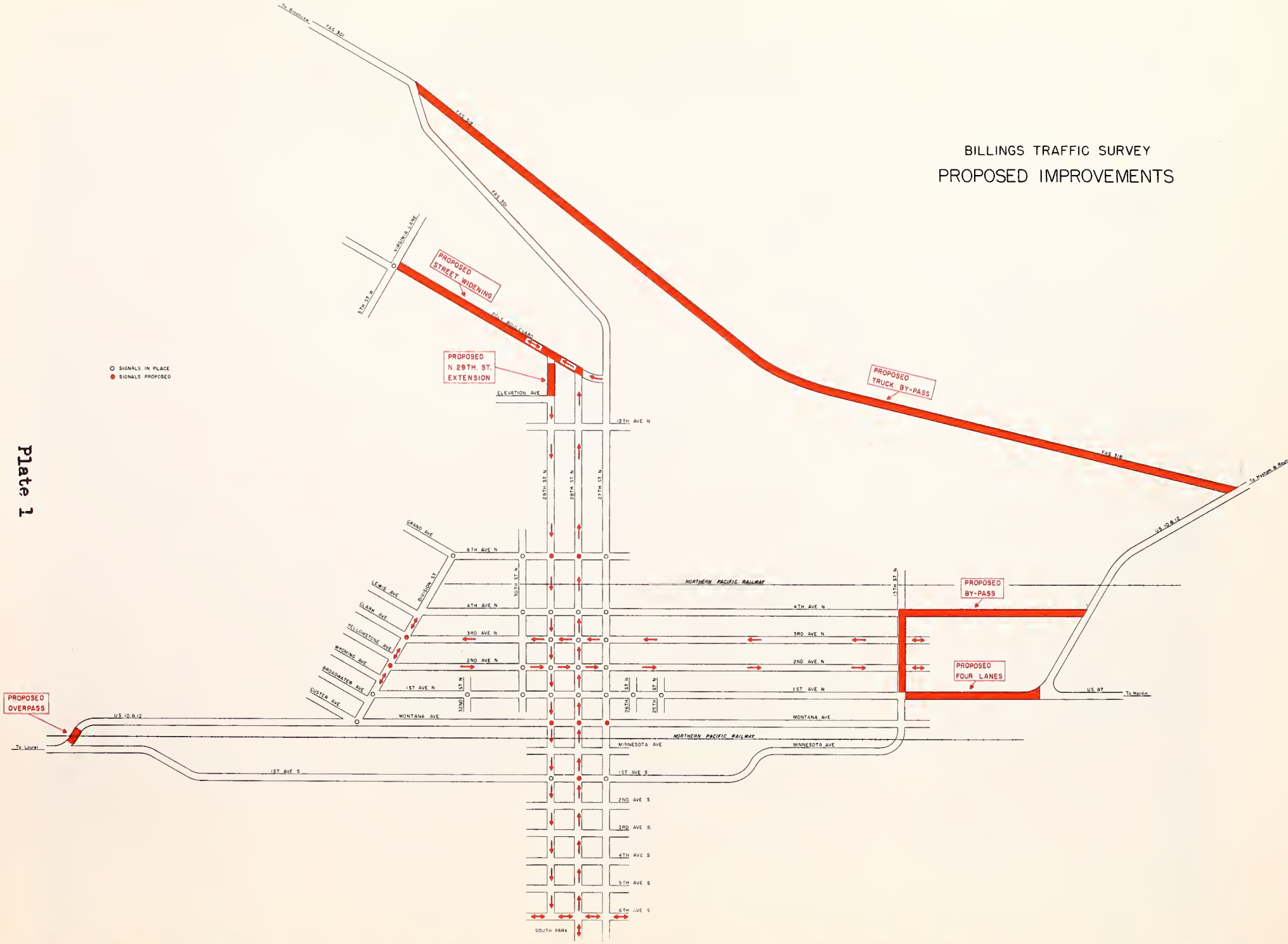


Wildcat Being Drilled in Southeastern Montana

Carter Oil Company Photo

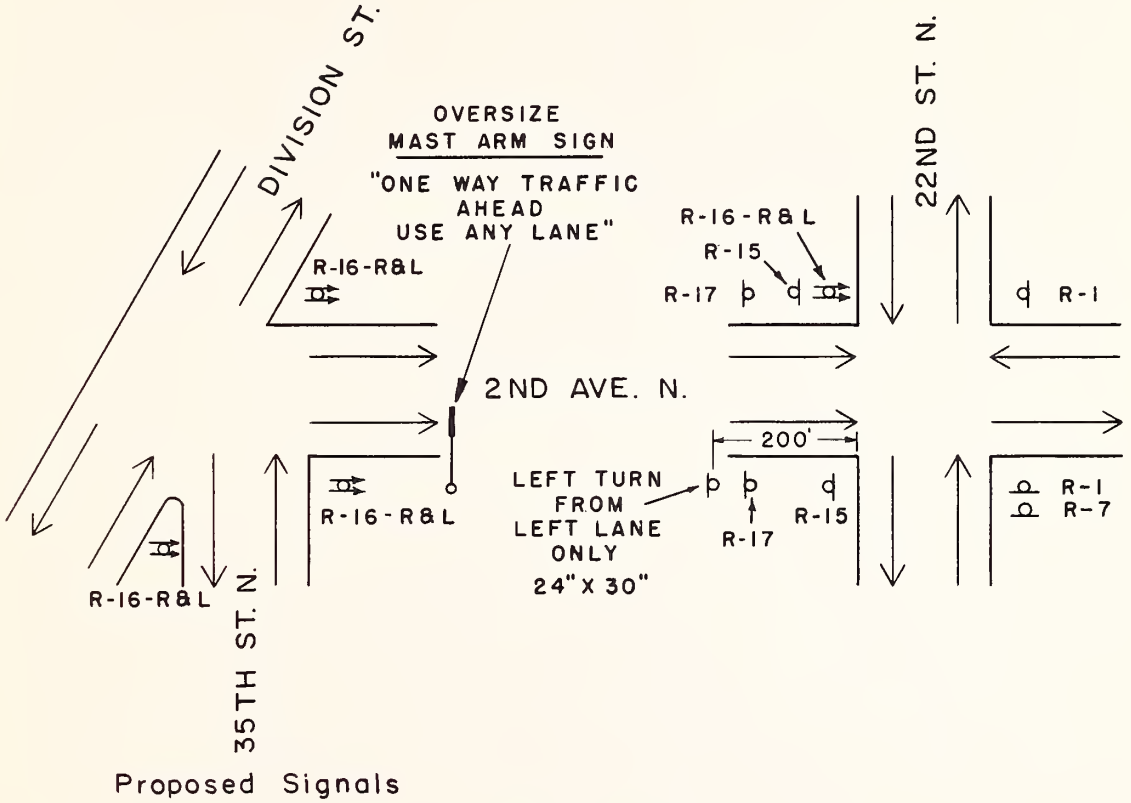
Plate 1

BILLINGS TRAFFIC SURVEY
PROPOSED IMPROVEMENTS



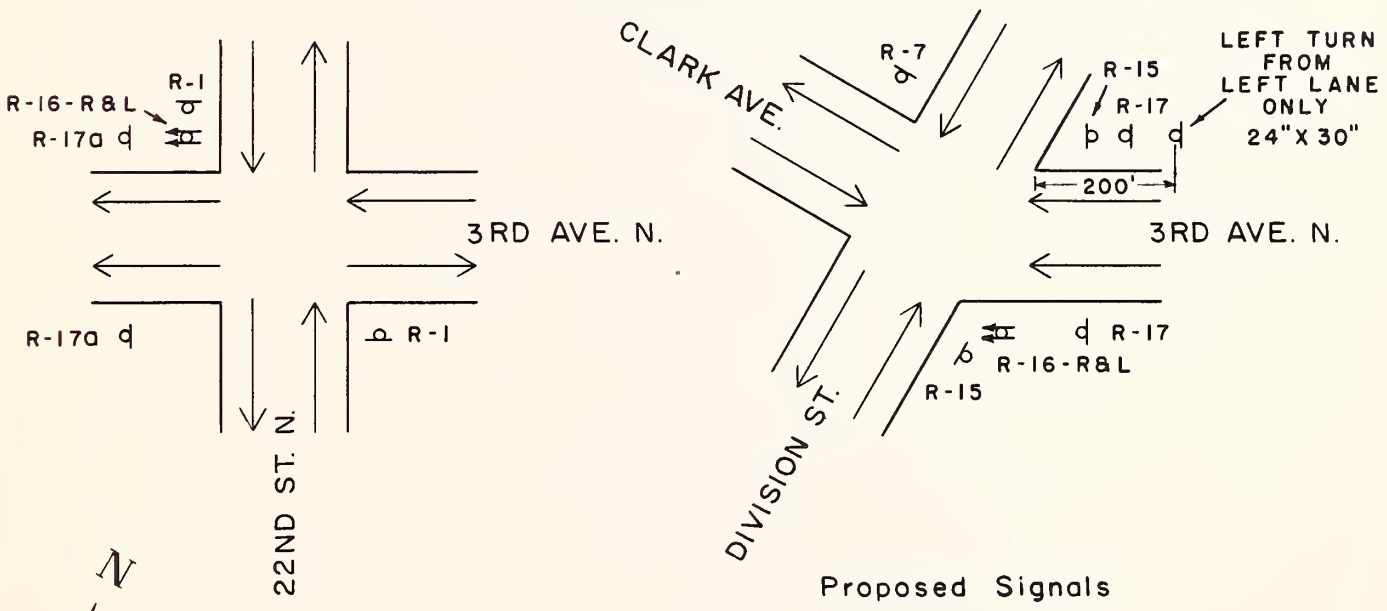
PROPOSED BILLINGS SIGNING

2ND. AVE. N.



Proposed Signals

3RD. AVE. N.

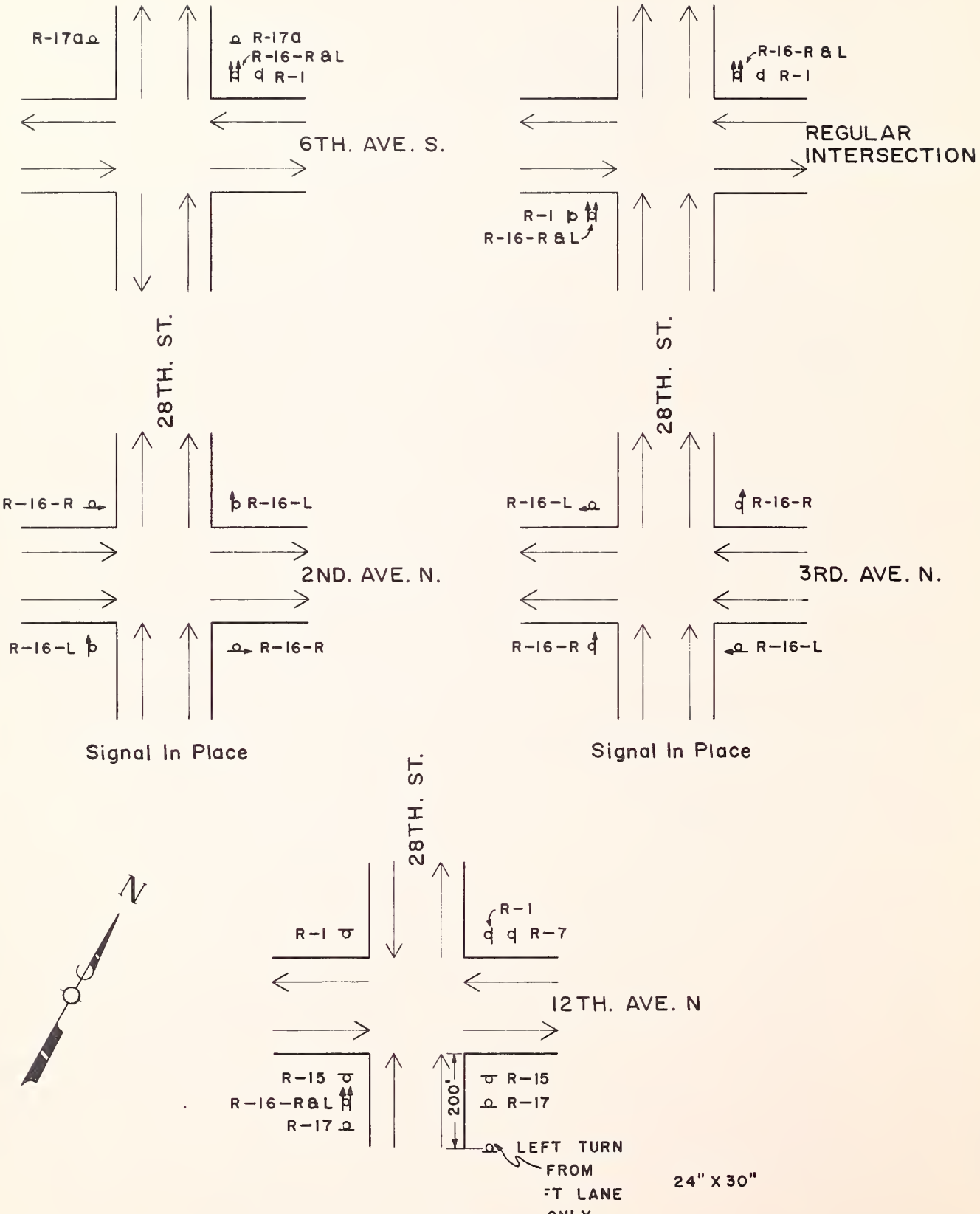


Proposed Signals

Plate 2

PROPOSED BILLINGS SIGNING

28TH. ST.

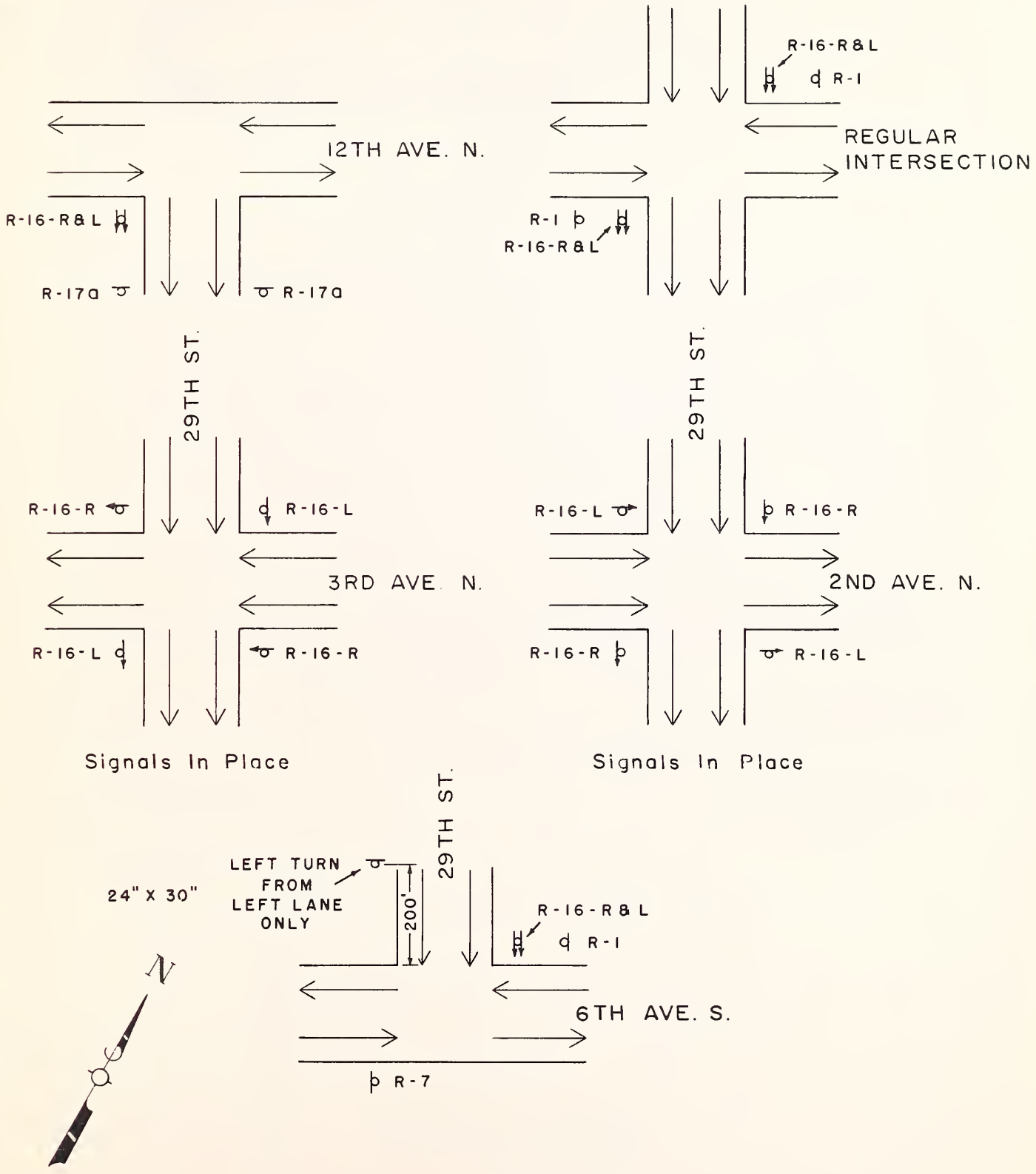


24" X 30"

Plate 3

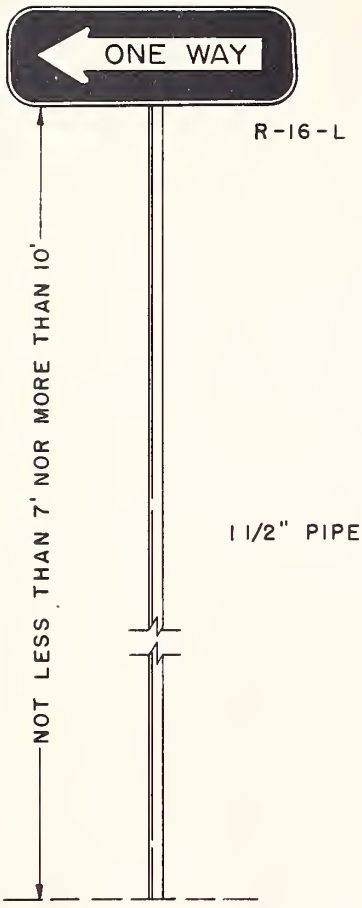
PROPOSED BILLINGS SIGNING

29TH. ST.



STANDARD SIGNS — ONE WAY STREETS

MANUAL on UNIFORM TRAFFIC CONTROL DEVICES



R-16-R
36"X12"

R-7
18"X24"

R-14
18"X24"

R-15
24"X24"

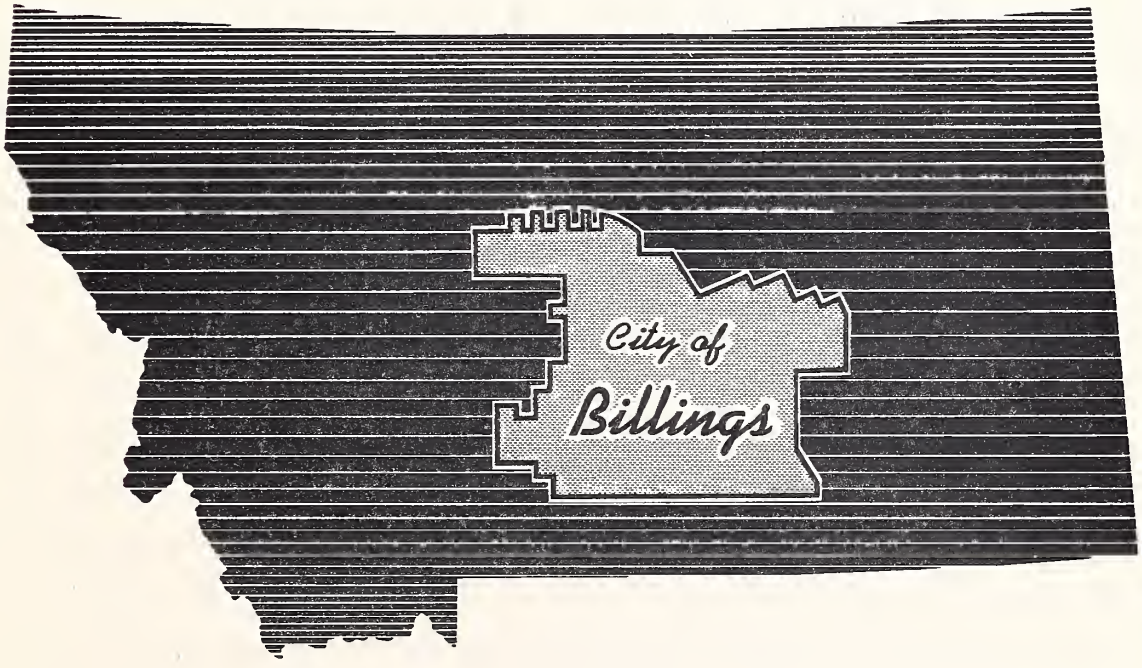
R-17
18"X24"

SPECIAL OVERHEAD SIGN

48"X72"

MAST ARM SUSPENDED RIGHT SIDE

Introduction



History & Development

HISTORY

The French explorers, Pierre and Francois de la Verendrye, are credited with being the first white men to penetrate the southeastern portion of the territory that was later to become Montana. It is thought that their party followed the Yellowstone River upstream at least as far as the present site of Billings. In the records of this expedition of 1742 and 1743 are many references to *The Land Of Shining Mountains* -- a name later applied to all of Montana.

Over a half century later, in 1806, the Lewis and Clark expedition came up the same river exploring the Louisiana Purchase for the United States Government. On July 25 of that year, Captain Clark carved his name and the date on a large rocky promontory just east of the present site of Billings which he named Pompeys Pillar.

With the exception of a fur trading post that was established at the mouth of the Big Horn River in 1808, the first half of the Nineteenth Century produced very few permanent settlements in the new territory. Indian raids from the south were a constant threat to the few hardy pioneers who had taken up land in the Yellowstone Valley even after 1850. Custer's Massacre in 1876 was the last major skirmish between the Sioux and Cheyenne Indians and the U.S. Cavalry and the subsequent treaties with these tribes brought peace to the area and opened the door to an influx of permanent settlers.

By 1877 a stage line had been established between Bozeman and Miles City, and the town of Coulson, on the Yellowstone River just southeast of Billings, came into existence as a stopover point on the new line. Five years later Coulson could boast of a post office, three stores, a brewery, five saloons, and thirty other buildings. Early accounts describe this community as an *Oasis Of Joy* for bullwhackers, cowboys, Indians, and other early day adventurers. Boothill Cemetery near the present site of Billings became the final resting place of many unfortunate citizens of Coulson who were just a *mite*

slow on the draw.

The rumor of the coming of the Northern Pacific Railway to Montana inspired a group of promoters and financiers to form the Minnesota and Montana Land and Improvement Company in 1881. This company purchased two adjoining sections of land for a townsite and contracted with the railroad for every other section of land on either side of the right-of-way for a considerable distance. In March of 1882 the new townsite called Billings was laid out on a scale to accommodate at least 20,000 people. Lots and farmland were advertized as far east as New York and by May of 1882 the boom was on. Over 5,000 lots were sold within 30 days and newcomers were clamoring for space to pitch their tents. The inhabitants of the rival town of Coulson watched the Billings boom in the summer of 1882 with some scorn but even the staunchest supporters gave up and moved to Billings after the railroad missed their town entirely and located its division point in the new city.

The growing pains of the new community were made more acute by the shortage of water. This precious commodity was dipped from the river, barrelled, and peddled on a house to house basis. The threat of fire was always present and several entire blocks burned. To alleviate the water shortage a canal was constructed to bring water from the Yellowstone River along the rimrocks above the town. This canal was the forerunner of the present irrigation system which provides water for a large portion of the fertile Yellowstone River valley.

The creation of Yellowstone County with Billings as the County Seat gave the young settlement a new boost in 1883. The most important event of this year however was probably the formation of the Billings Board of Trade. This predecessor of the present day Chamber of Commerce was formed by Billings businessmen to promote trade and industry and was instrumental in having roads constructed to the north into the Musselshell country and to the south to draw trade from Northern Wyoming. Much of the City's growth can be credited to this organization.

By 1890 Billings had settled down from its initial boom to a steady growth as a trading center for a large portion of Eastern Montana and Northern Wyoming. This steady growth was to continue until after the Second World War and the discovery of oil in Montana's portion of the Williston Basin. Now the city is again experiencing a boom which is reminiscent of its early beginnings. Residential and commercial construction are at a new high and total bank debits and postal receipts lead all Montana cities. The business talk in Billings today is optimistic with the magic word *oil* frequently entering the conversation.

INDUSTRY AND COMMERCE

Agriculture, especially the livestock industry, is the foundation of the economy of Billings. Nearly 40 per cent of all cattle marketed in Montana are processed through the Billings livestock markets. Such industries as livestock yards, packing houses, a sugar factory, vegetable cannery, and flour and cereal mills are proof of the importance of agriculture.

The sale and distribution of commodities can be ranked second in the general economy of Billings. During 1953 it was estimated that there were 150 wholesale outlets and over 420 retail stores operating in the metropolitan area. These establishments serve a trade area of nearly three million acres of farmland.

In recent years Billings has become one of the principal refining centers of petroleum products in the Northwest. Pipe lines bring crude oil to the refineries from the Elk Basin fields in southern Montana and northern Wyoming. Two additional pipe lines to handle refined products were completed during 1954 to Spokane, Washington and Glendive, Montana. The City is also the administrative center for the major oil companies now operating in the new Williston Basin field of western North Dakota and eastern Montana. Further development of this field should expand and stabilize the petroleum industry of Billings.

TRANSPORTATION

Billings is served by two transcontinental highways U.S. 10 and U.S. 87, both of which are on the Interstate System. County and secondary highways provide adequate land service to the adjacent areas.

Three railroads, the Northern Pacific, Great Northern, and the Burlington, provide fast passenger and freight service to all parts of the nation.

Northwest, Western, and Frontier Air Lines serve Billings from a modern airport just north of the City. Northwest Airlines operates a maintenance and repair shop at the municipal airport.

Over 300 motor freight carriers operating both interstate and intrastate connect the City with most of the important centers of population. Two bus lines, Greyhound and American, provide daily passenger service.

TRAFFIC PROBLEMS

The rapid growth of Billings since World War II has created some major problems in vehicular transportation within the City. Land west of Billings that was utilized for farming a few years ago has now been subdivided into residential areas for a distance of five miles from the City Center. The subdivision of this land has been done outside the corporate limits with little regard for street planning. Consequently there are few streets that can be used as arterials between the old additions and the new subdivisions. Those streets that do run through have a variety of widths some of which are too narrow to carry present traffic loads.

In the original townsite, streets that were formerly adequate to carry residential traffic are now being overloaded and many arterials are quickly reaching their practical traffic capacity. U.S. 10 and 12, Montana's heaviest traveled, interstate route, traverses the City from east to west adding a considerable amount of through traffic to the already congested central

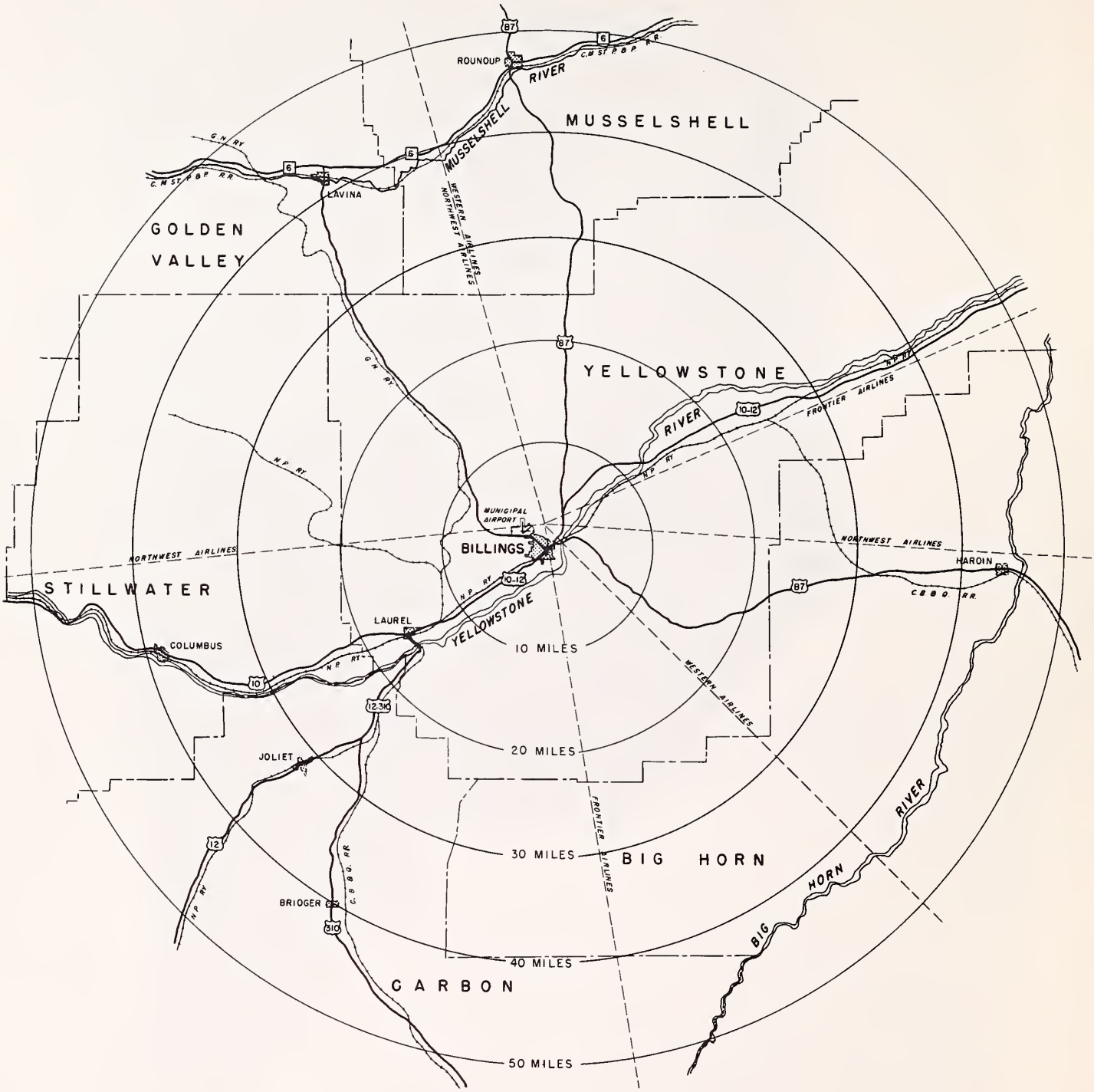
business district. Parking space in the downtown area has become one of the major headaches of the motorist in spite of the establishment of several additional off street parking lots. Due to the parking problem downtown, shopping centers are already being established in the suburban areas -- the start of a trend toward decentralization of business.

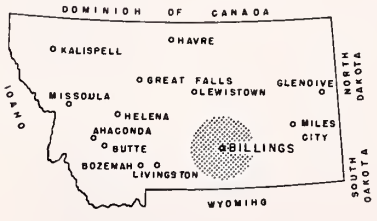
Many of the present traffic problems can be attributed to the rapid expansion of the City without benefit of a master plan. Realizing this, the city officials of Billings recognized the need for current traffic data on which to base a future major street system and to set up priorities for improvements.

In 1954 the Montana Highway Commission and the Bureau of Public Roads were requested by the City to participate in a comprehensive traffic survey of the metropolitan area. The survey which was conducted in July and August of 1954 included internal and external origin and destination surveys, capacity studies at major intersections, a parking survey, and speed and delay studies on major routes through the City.

This report presents the results of these various studies and attempts to recommend solutions to the more pressing traffic problems in Billings.

Broadway -- About 1914





DIAGRAMMATIC MAP
OF
MONTANA

BILLINGS TRAFFIC SURVEY

VICINITY MAP

Plate 6

BILLINGS TRAFFIC SURVEY

POPULATION AND MOTOR VEHICLE TRENDS
BILLINGS AND YELLOWSTONE COUNTY

SUMMARY			
YEARS	1940–1950	1954–1964	1954–1974
City Population	37%	26%	54%
Vehicle Registration	66%	30%	61%
County Population	36%	20%	39%

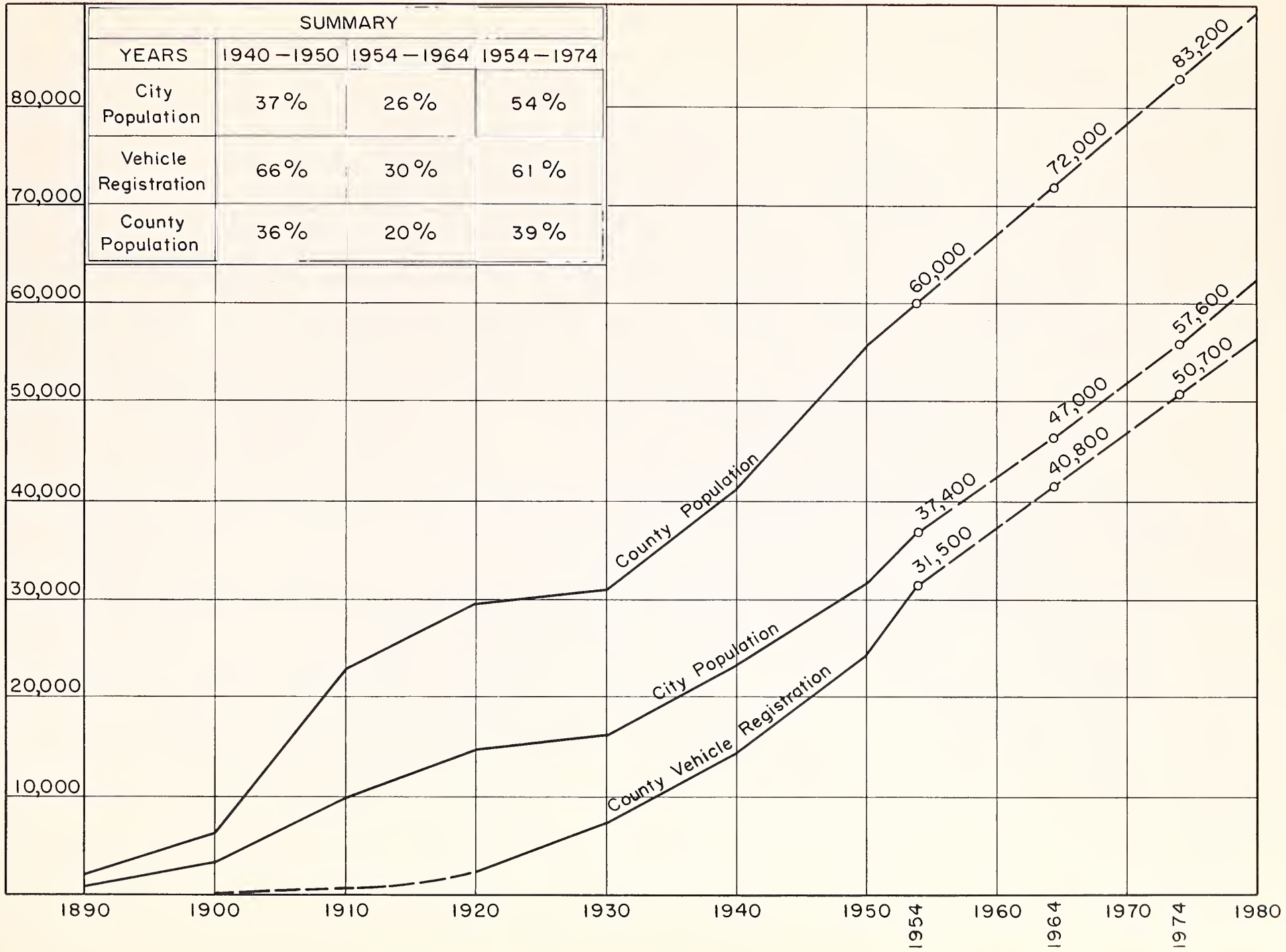
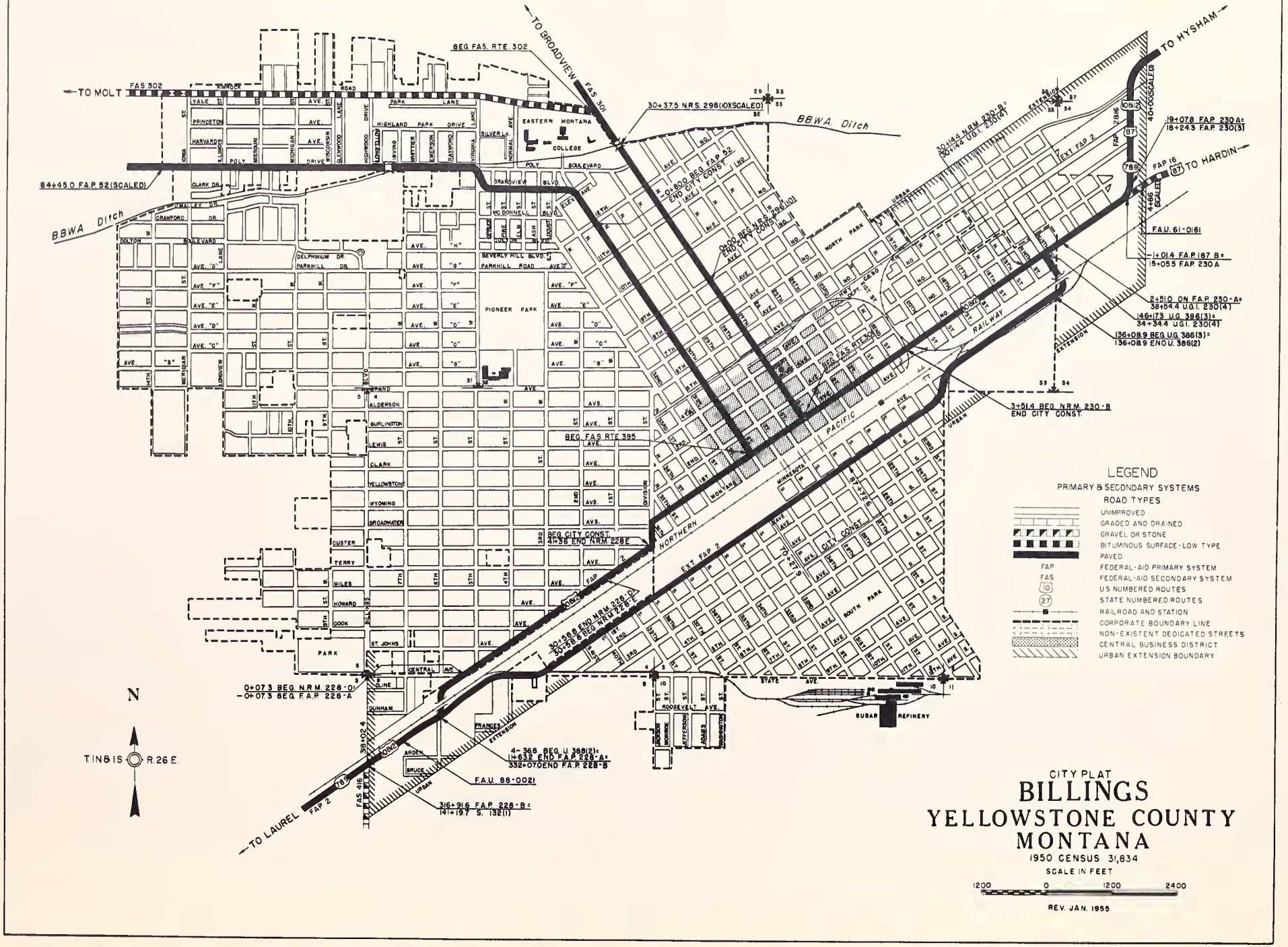


Plate 7



CITY PLAT

BILLINGS

YELLOWSTONE COUNTY

MONTANA

1950 CENSUS 31,834

SCALE IN FEET

1200 0 1200 2400

REV. JAN. 1955

BILLINGS TRAFFIC SURVEY

LAND USE

WITHIN

CORPORATE LIMITS

FEBRUARY 1954

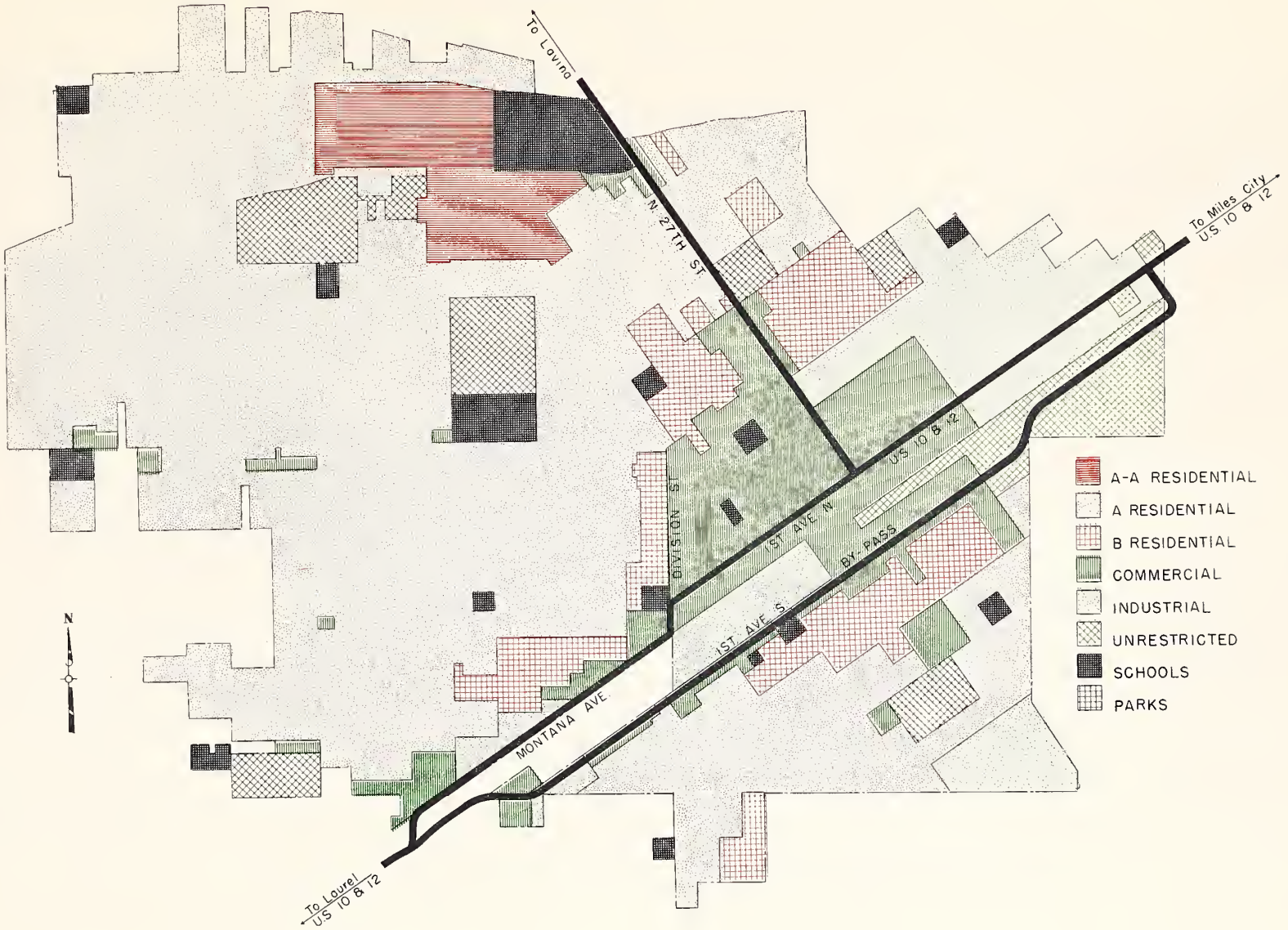
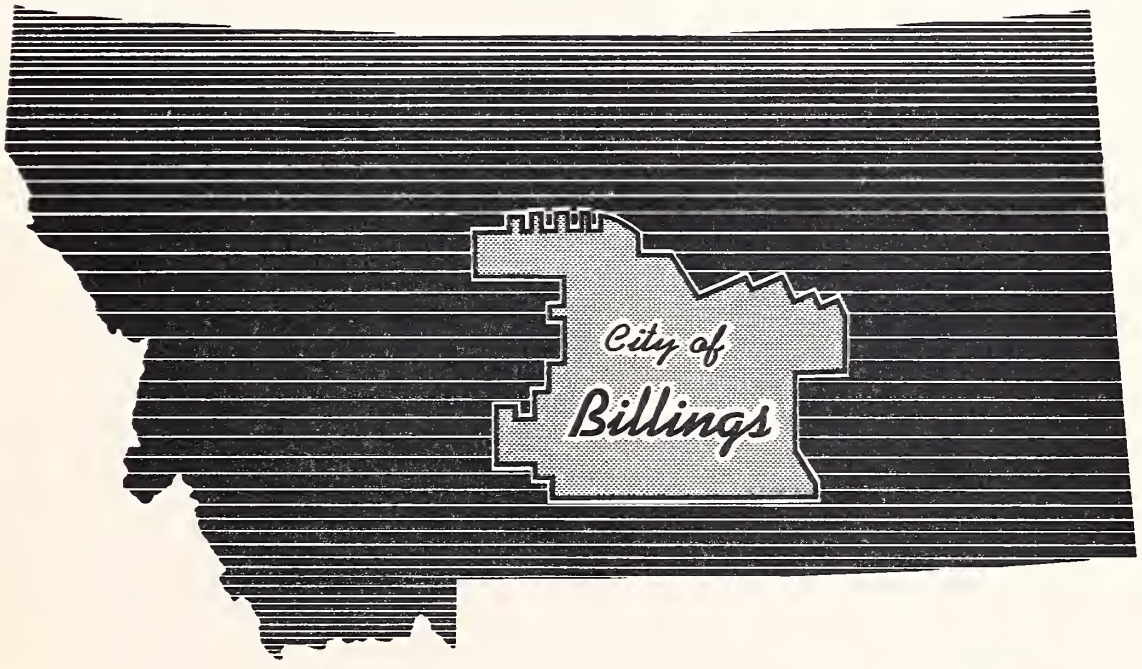


Plate 9

Broadway -- 1954

Part One



Traffic Volumes

TRAFFIC VOLUMES

To obtain adequate information on the present use of the city streets of Billings, vehicular volume counts were taken at all major street intersections. These manual turning movement counts were supplemented by machine counts of at least one week's duration at key locations. The results of these counts are graphically presented on the following charts.

Counts at the master station located on First Avenue North showed that traffic volumes in the downtown area varied as much as 15 per cent between Monday and Friday of a typical week. Traffic on Monday was nearest to average for weekdays with Friday the highest and Tuesday the lowest. Complete results of this analysis are shown on Plate 12.

The hourly and daily pattern of traffic volumes is shown on Plates 10 and 11. It will be noted that the peak hour occurs between 4:30 and 5:30 P.M. when late shoppers and workers are returning home from the downtown area. During this one hour over 8 per cent of the total 24 hour traffic is on the city streets.

If a street system can be designed to adequately handle the peak hour of traffic, there should be very little congestion during the other 23 hours of an average day. With this fact in mind, Plate 14 was prepared to show the traffic flow on the principal streets in Billings during the peak hour of 4:30 - 5:30 P.M.

The thirtieth maximum hour occuring during the year has generally been accepted as a traffic volume for which a highway or street facility can be most practically and economically designed. Due to the lack of continuous counts, data on the exact thirtieth maximum hour are not available in Montana's urban areas. In lieu of complete counts a method of approximating the thirtieth maximum hour has been devised. This method consists briefly of plotting the maximum recorded hours at the master station over a period of two weeks in July and August. A *design hour* is then selected where the

slope of the curve starts to change rapidly upward. After the design hour has been established at the control station all other short peak hour counts are adjusted to the control station traffic pattern. The *design hour* has been used as a basis for computing intersection capacities in Billings.

BILLINGS TRAFFIC SURVEY
HOURLY TRAFFIC VOLUME PATTERN
1ST AVENUE NORTH - BETWEEN 28TH & 29TH STREETS

JULY 1954

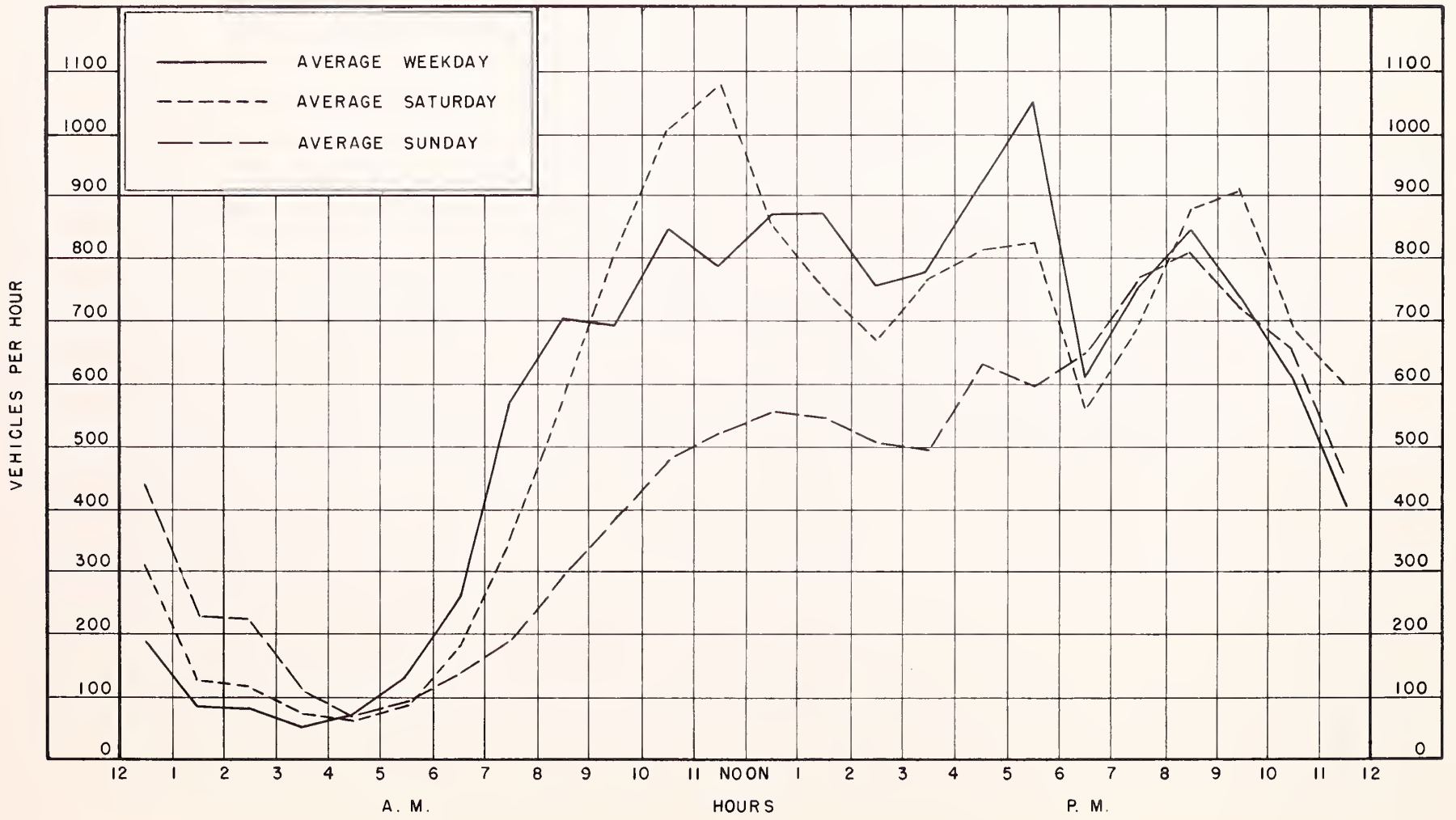
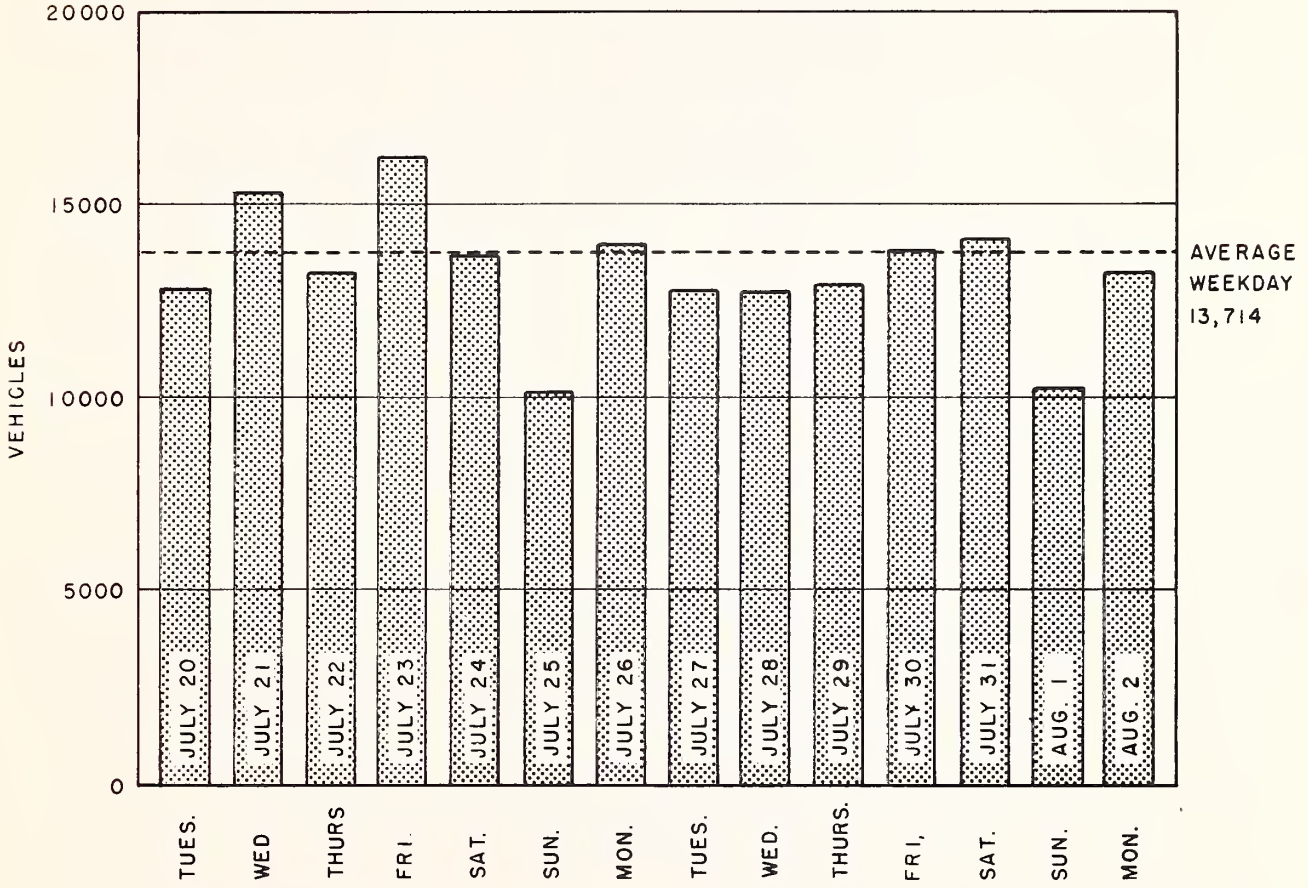


Plate 10

BILLINGS TRAFFIC SURVEY
COMPARISON OF
DAILY & PEAK HOUR TRAFFIC VOLUMES
MASTER STATION - JULY 20 - AUGUST 2, 1954

DAILY TRAFFIC VOLUMES



PEAK HOUR TRAFFIC VOLUMES
4:30 - 5:30 P. M.

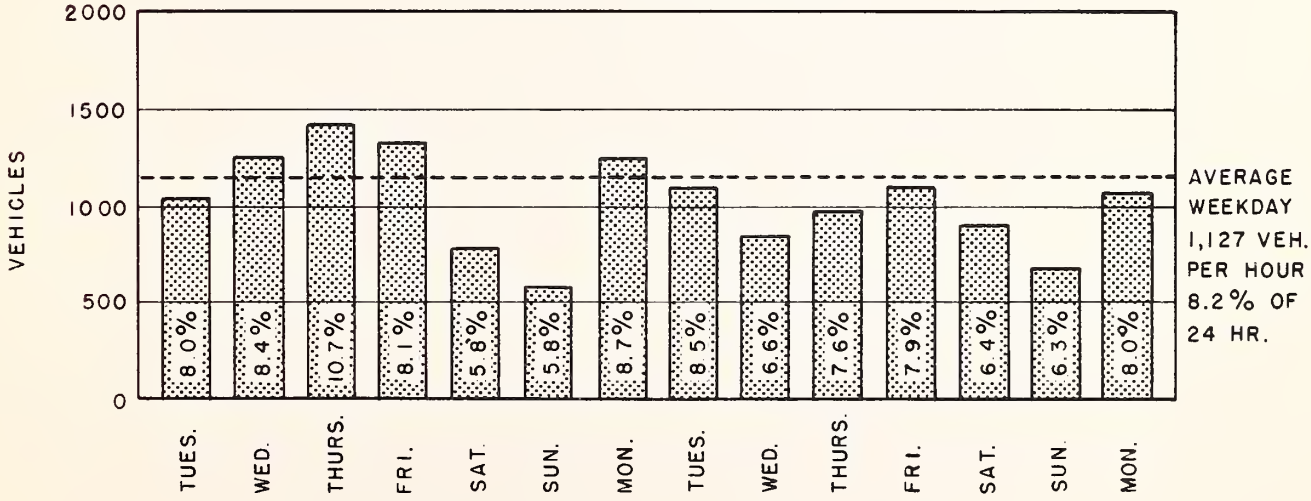
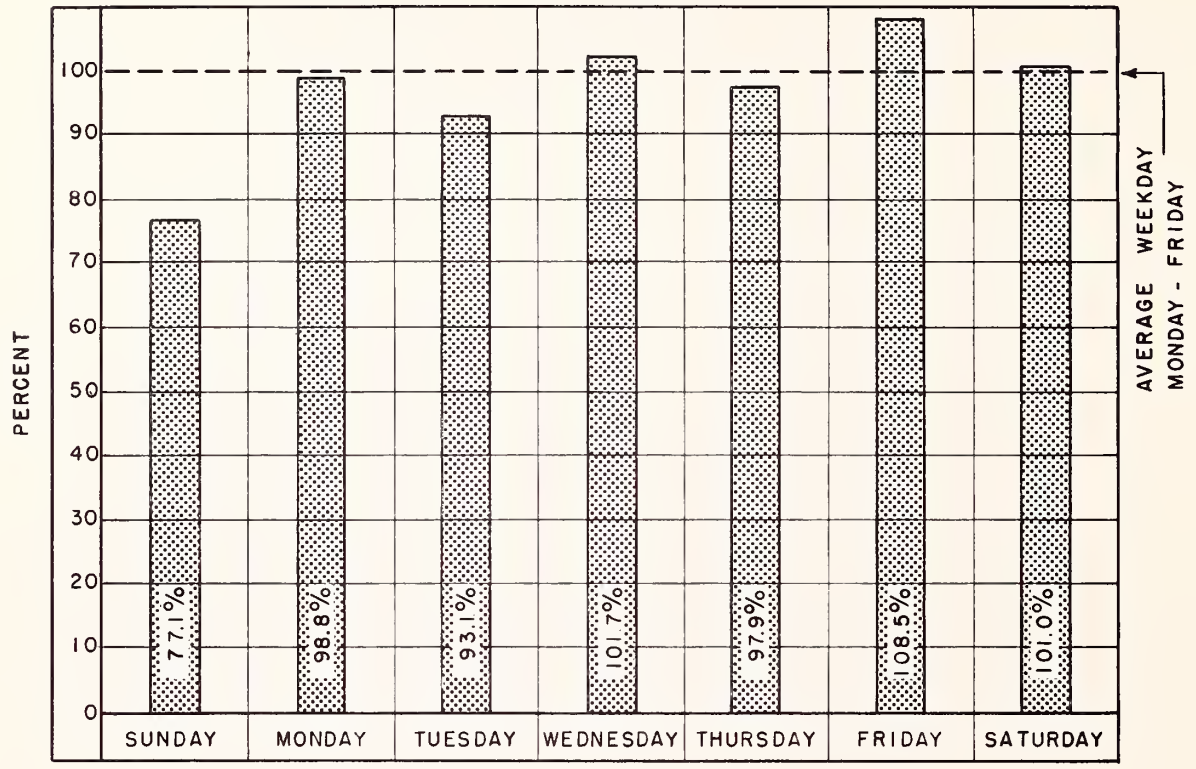


Plate 11

BILLINGS TRAFFIC SURVEY
DAILY VARIATION & HOURLY PERCENTAGE
MASTER STATION
1ST AVENUE NORTH - BETWEEN 28TH & 29TH STREETS

JULY 1954



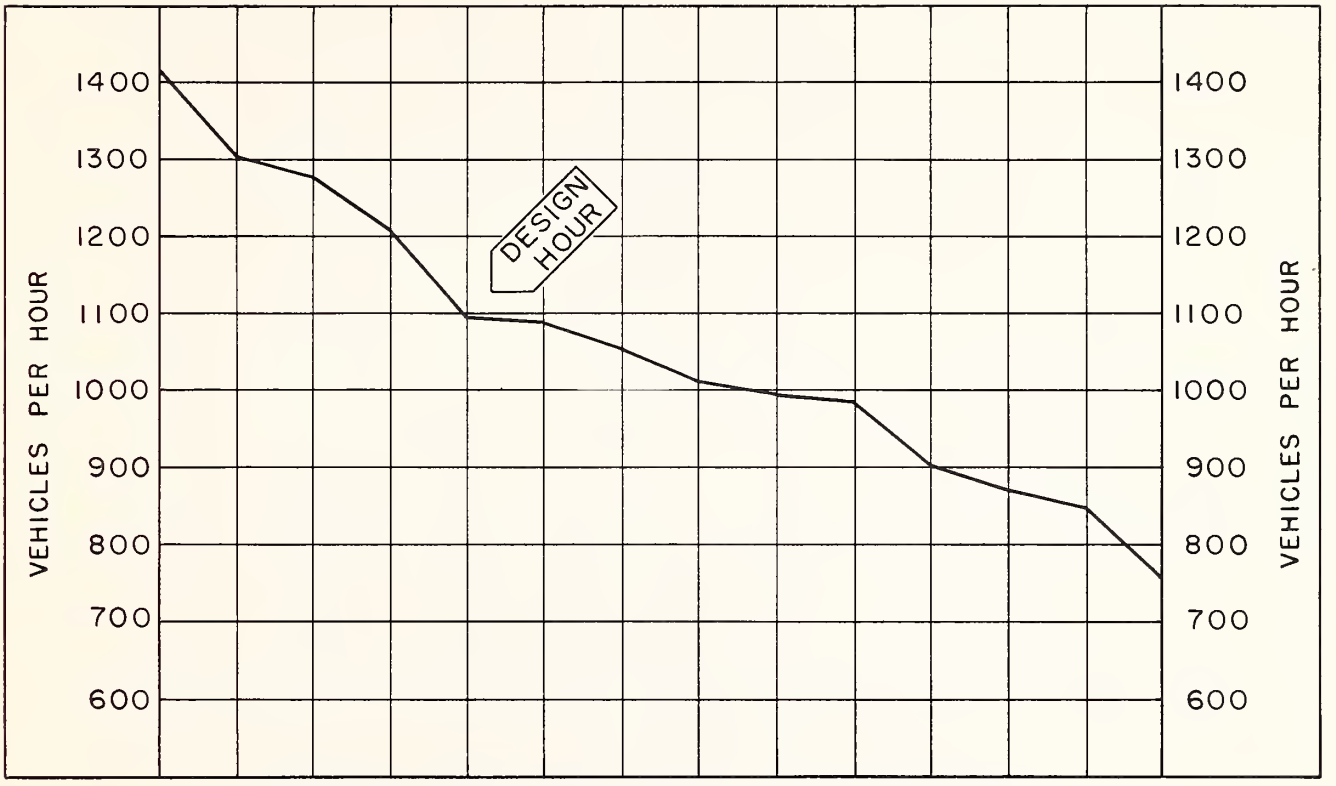
HOURLY PERCENTAGE
AVERAGE WEEKDAY

HOURS A. M.	PERCENT	HOURS P. M.	PERCENT
12-1	1.4	12-1	6.4
1-2	0.6	1-2	6.4
2-3	0.6	2-3	5.5
3-4	0.4	3-4	5.7
4-5	0.5	4-5	6.7
5-6	0.9	5-6	7.8
6-7	1.9	6-7	4.4
7-8	4.2	7-8	5.5
8-9	5.1	8-9	6.2
9-10	5.1	9-10	5.3
10-11	6.2	10-11	4.5
11-12	5.8	11-12	2.9

BILLINGS TRAFFIC SURVEY

PEAK HOUR VOLUMES AND DESIGN HOUR

4:30 - 5:30 P.M.



HIGHEST RECORDED PEAK HOUR VOLUMES

ON 1ST. AVE. N.

BETWEEN

28TH. ST. N. & 29TH. ST. N.

NO.	DAY	DATE	PEAK HOUR VOLUME	DESIGN FACTOR	
1	THURSDAY	JULY 22	1417	0.77	
2	FRIDAY	JULY 23	1303	0.84	
3	WEDNESDAY	JULY 21	1276	0.86	
4	MONDAY	JULY 26	1211	0.90	
5	TUESDAY	JULY 27	1091	1.00	DESIGN HOUR
6	FRIDAY	JULY 30	1082	1.01	
7	MONDAY	AUG. 2	1053	1.04	
8	TUESDAY	JULY 20	1013	1.08	
9	SATURDAY	JULY 24	991	1.10	
10	THURSDAY	JULY 29	980	1.11	
11	SATURDAY	JULY 31	900	1.21	
12	SUNDAY	AUG. 1	871	1.25	
13	WEDNESDAY	JULY 28	840	1.30	
14	SUNDAY	JULY 25	753	1.45	

BILLINGS TRAFFIC SURVEY

TRAFFIC FLOW DIAGRAM

PEAK HOUR (4 30 TO 5 30 PM)

JULY 1954

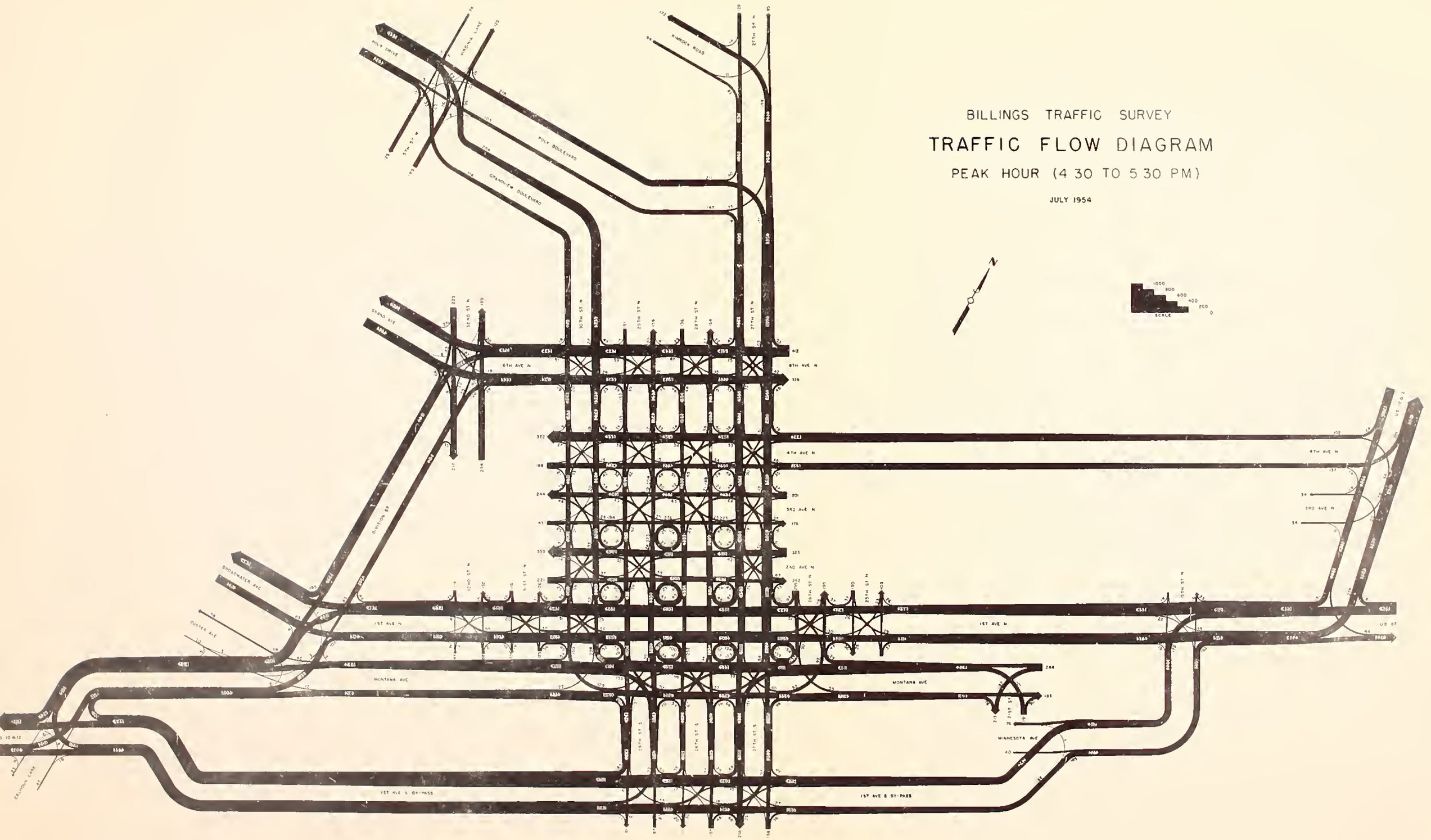
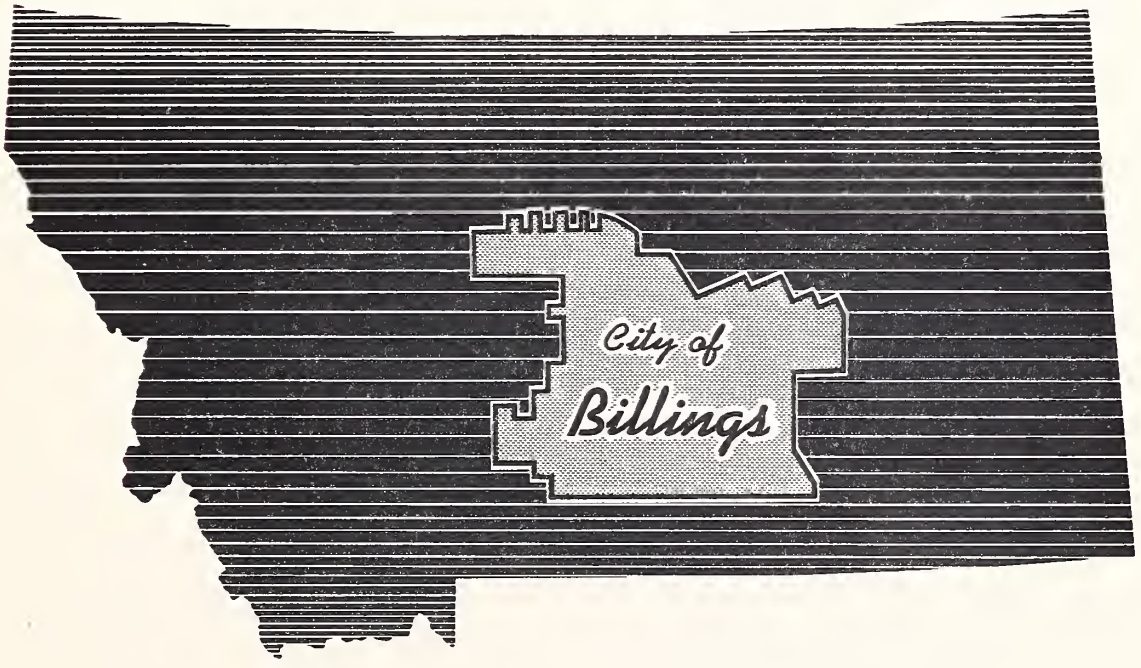


Plate 14

Part Two

Inner Cordon



Origin & Destination Survey

INNER CORDON ORIGIN AND DESTINATION SURVEY

An inner cordon type origin and destination survey is a study of the travel habits of only those vehicles crossing a predetermined cordon line usually surrounding the central business district. Field data can be obtained by various methods, such as stopping and interviewing the motorist at the cordon line, passing out post cards or interviewing the occupants of dwellings in the area.

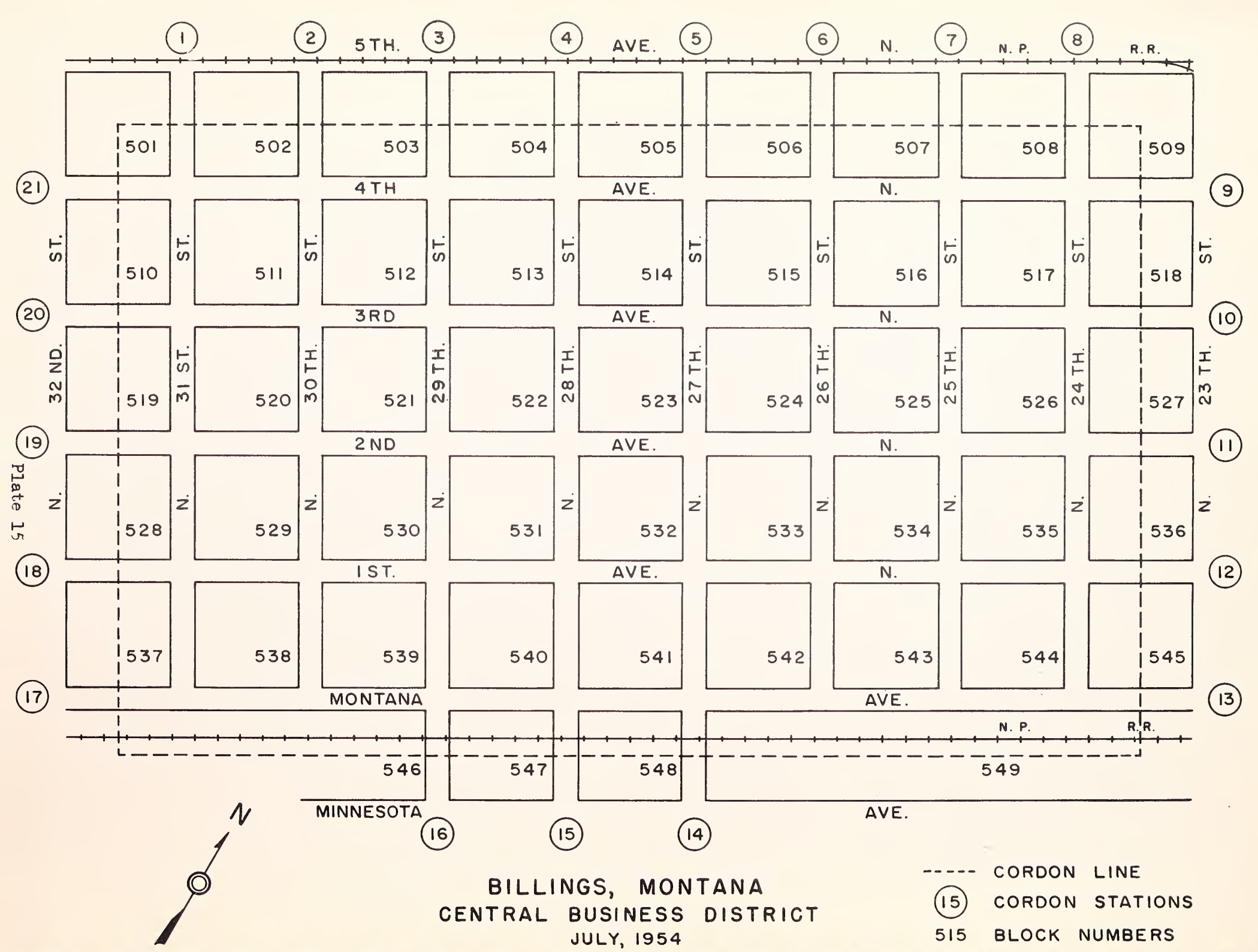
In Billings the cordon type, road side interview method was used to obtain the necessary field data. A cordon line enclosing 49 blocks was established on the fringe of the business district and outbound traffic was interviewed at 21 locations on the cordon line. All stations were operated for a minimum of 16 hours and three stations on First Avenue North and 27th Street were operated for a full 24 hours. Motorists were stopped and questioned concerning their origin, destination, trip purpose, length of time parked, and type of parking used.

The outbound traffic movement from the central business district on an average weekday in July totaled 59,650 vehicles. Of this number 30,084 drivers were interviewed or approximately 51 per cent. During the hours of survey, interviews were obtained from approximately 75 per cent of the total outbound traffic movement.

Factors for expanding the interview sample to a 24 hour average were derived from manual, directional counts taken at each station while the interviews were in progress. These counts were also used to determine the peak hour of vehicle accumulation within the cordon area. In addition to the manual counts, directional machine counts were taken at each station previous to the start of the interviewing to determine normal weekday traffic.

In analysing origin and destination data it is necessary that vehicle trips be summarized into groups large enough to indicate significant traffic patterns. For this reason the Billings urban area was divided into 68 zones more or less homogeneous as to land use characteristics. In analysing zone to zone trips through the business district, it was found to be advantageous to further group various zones into six areas in order to simplify the main traffic movements.

The following series of charts show the desire lines of travel into and through the Billings central business district.

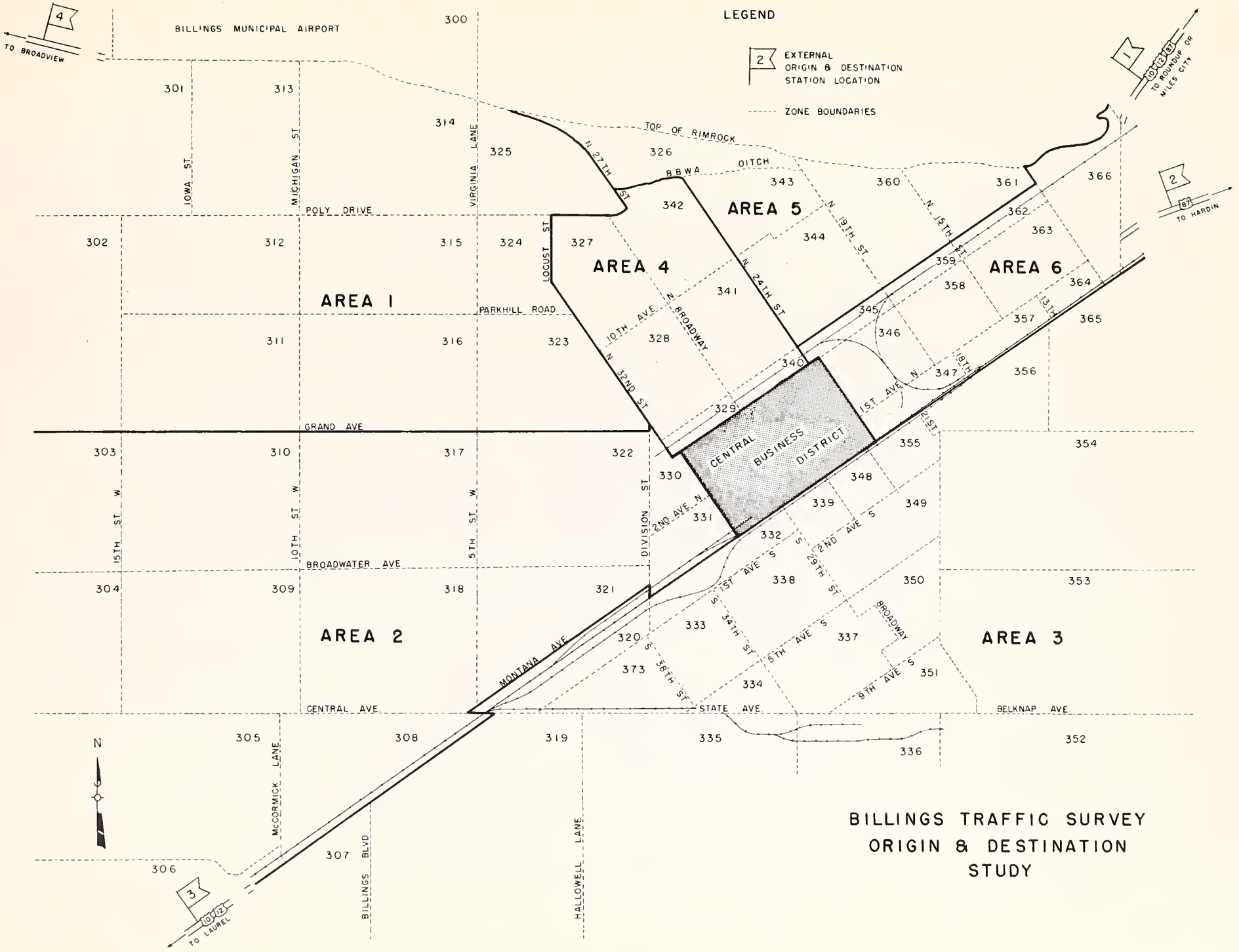


BILLINGS, MONTANA
CENTRAL BUSINESS DISTRICT
JULY, 1954

----- CORDON LINE

(15) CORDON STATIONS

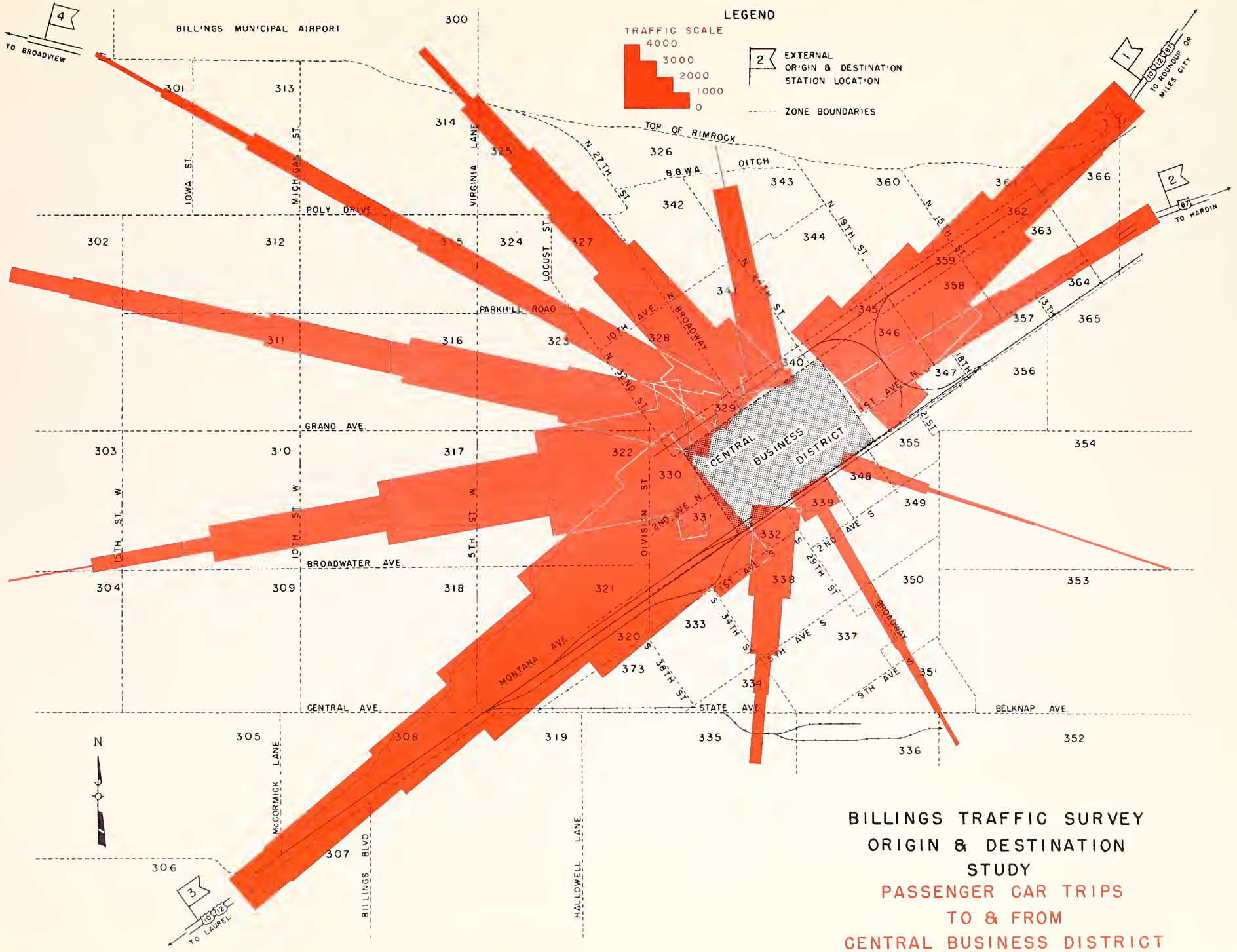
515 BLOCK NUMBERS



BILLINGS TRAFFIC SURVEY ORIGIN & DESTINATION STUDY

PASSENGER CAR AND LIGHT TRUCK TRIPS TO AND FROM THE CENTRAL BUSINESS DISTRICT

Plate 17 illustrates the approximate desire lines of 51,219 passenger car and light truck trips that had either an origin or destination in the central business district on an average weekday in July 1954. These trips represent 63 per cent of the total traffic crossing the inner cordon line and 14 per cent of them came from or returned to points outside the metropolitan area.

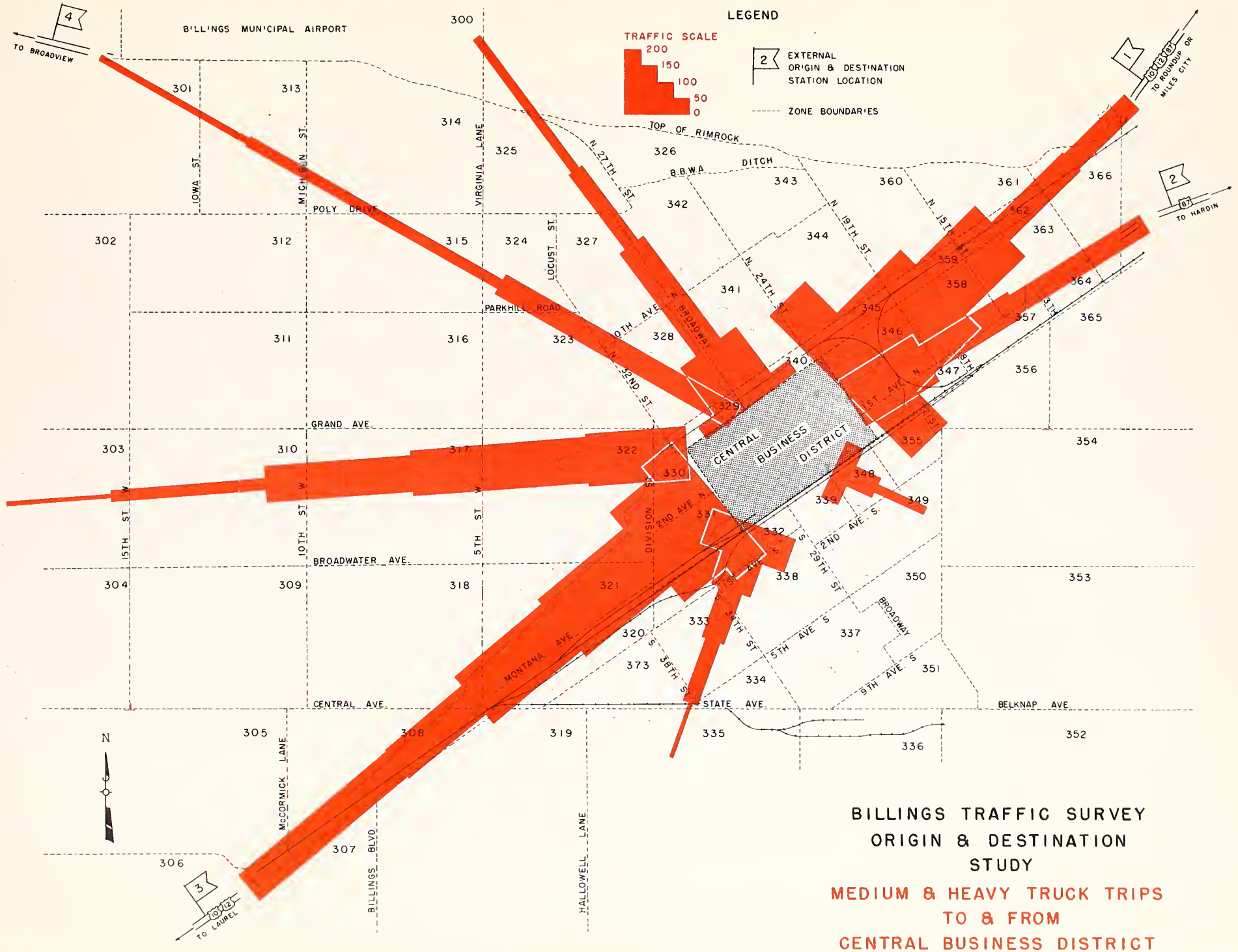


BILLINGS TRAFFIC SURVEY
ORIGIN & DESTINATION STUDY
PASSENGER CAR TRIPS TO & FROM CENTRAL BUSINESS DISTRICT

Plate 17

MEDIUM AND HEAVY TRUCK TRIPS TO AND FROM THE CENTRAL BUSINESS DISTRICT

Plate 18 illustrates the approximate desire lines of 2,104 medium and heavy truck trips that had either an origin or destination in the central business district on an average weekday in July 1954. These trips represent 3 per cent of the total traffic crossing the inner cordon line and 11 per cent of them came from or returned to points outside the metropolitan area.

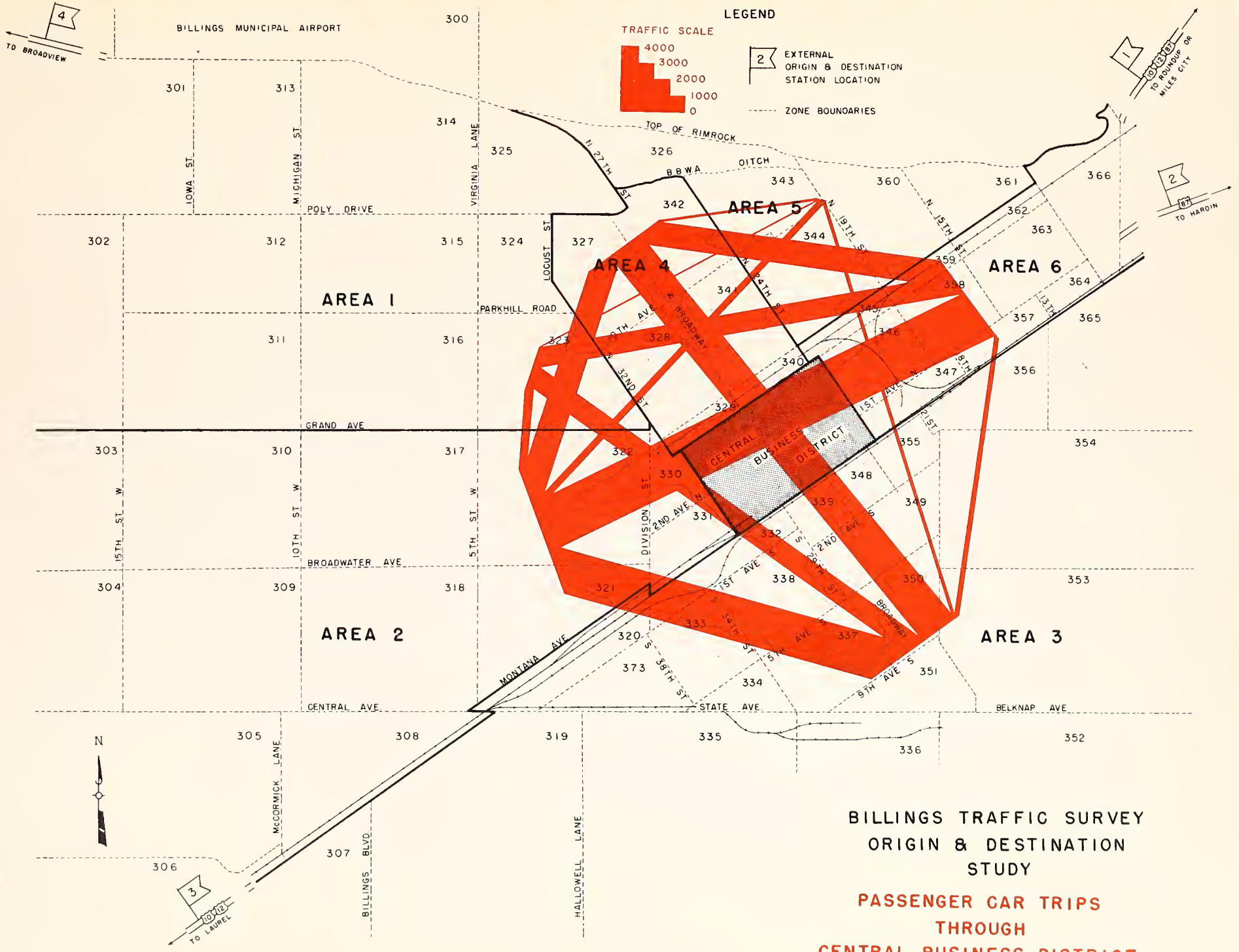


BILLINGS TRAFFIC SURVEY
ORIGIN & DESTINATION STUDY
MEDIUM & HEAVY TRUCK TRIPS TO & FROM CENTRAL BUSINESS DISTRICT

Plate 18

PASSENGER CAR AND LIGHT TRUCK TRIPS THROUGH THE CENTRAL BUSINESS DISTRICT

Plate 19 illustrates the approximate desire lines of 18,690 passenger car and light truck trips that passed through the central business district on an average weekday in July 1954. These trips which represent 23 per cent of the total traffic crossing the inner cordon line could all theoretically by-pass the central business district.



BILLINGS TRAFFIC SURVEY
ORIGIN & DESTINATION STUDY

PASSENGER CAR TRIPS THROUGH CENTRAL BUSINESS DISTRICT

Plate 19

MEDIUM AND HEAVY TRUCK TRIPS THROUGH THE CENTRAL BUSINESS DISTRICT

Plate 20 illustrates the approximate desire lines of 1,214 medium and heavy truck trips through the central business district on an average weekday in July 1954. These truck trips which represent about 1 per cent of the total traffic crossing the inner cordon could also theoretically by-pass the central business district.

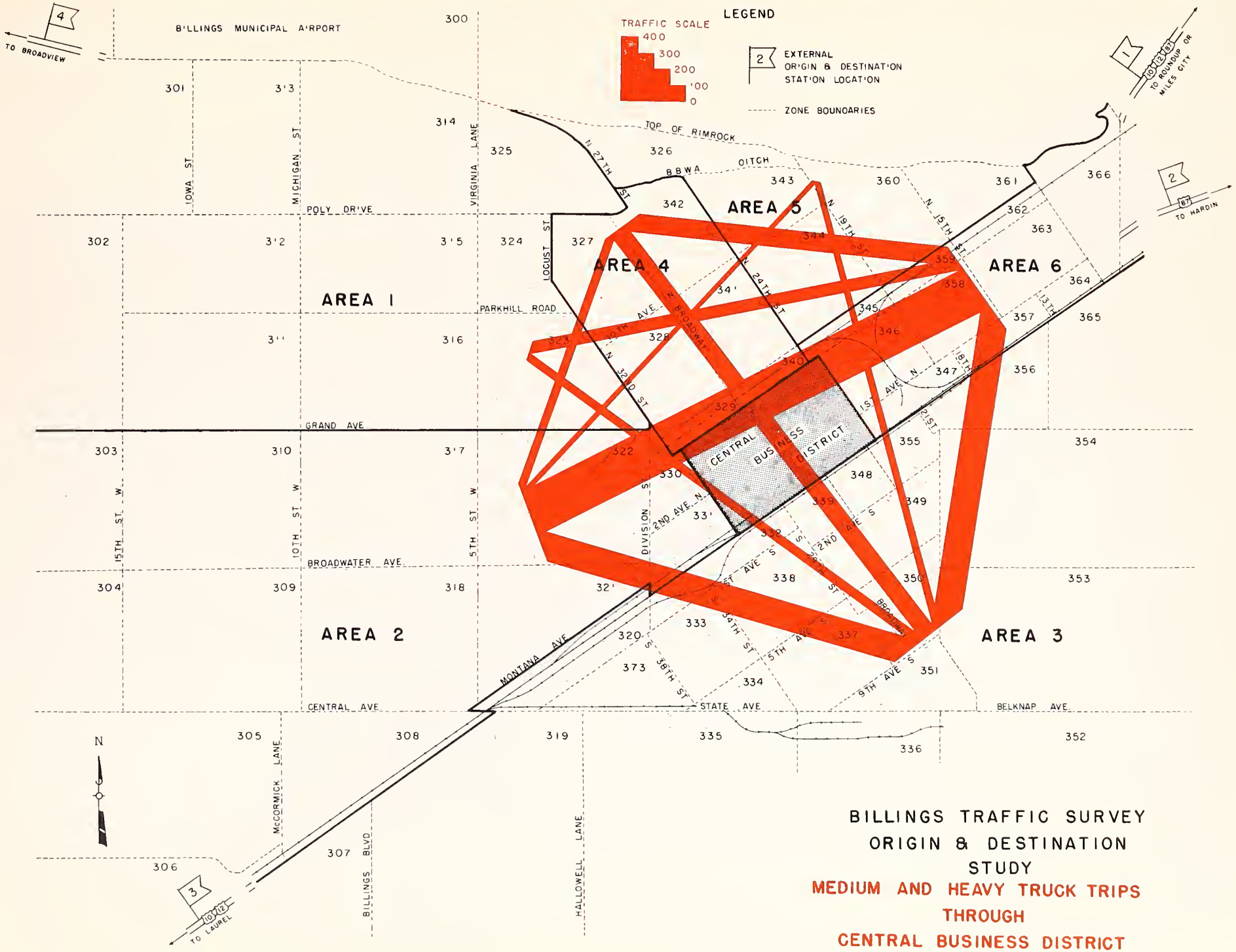


Plate 20

BILLINGS TRAFFIC SURVEY
ORIGIN & DESTINATION STUDY
MEDIUM AND HEAVY TRUCK TRIPS THROUGH CENTRAL BUSINESS DISTRICT

EXTERNAL PASSENGER CAR AND LIGHT TRUCK TRIPS THROUGH THE CENTRAL BUSINESS DISTRICT

Plate 21 illustrates the approximate desire lines of 7,700 passenger car and light truck trips that passed through the central business district from origins or destinations outside the metropolitan area. Approximately 29 per cent of these trips did not stop in the city. All of them could have theoretically by-passed the central business district. This segment of traffic represents 9 per cent of the total volume crossing the inner cordon line

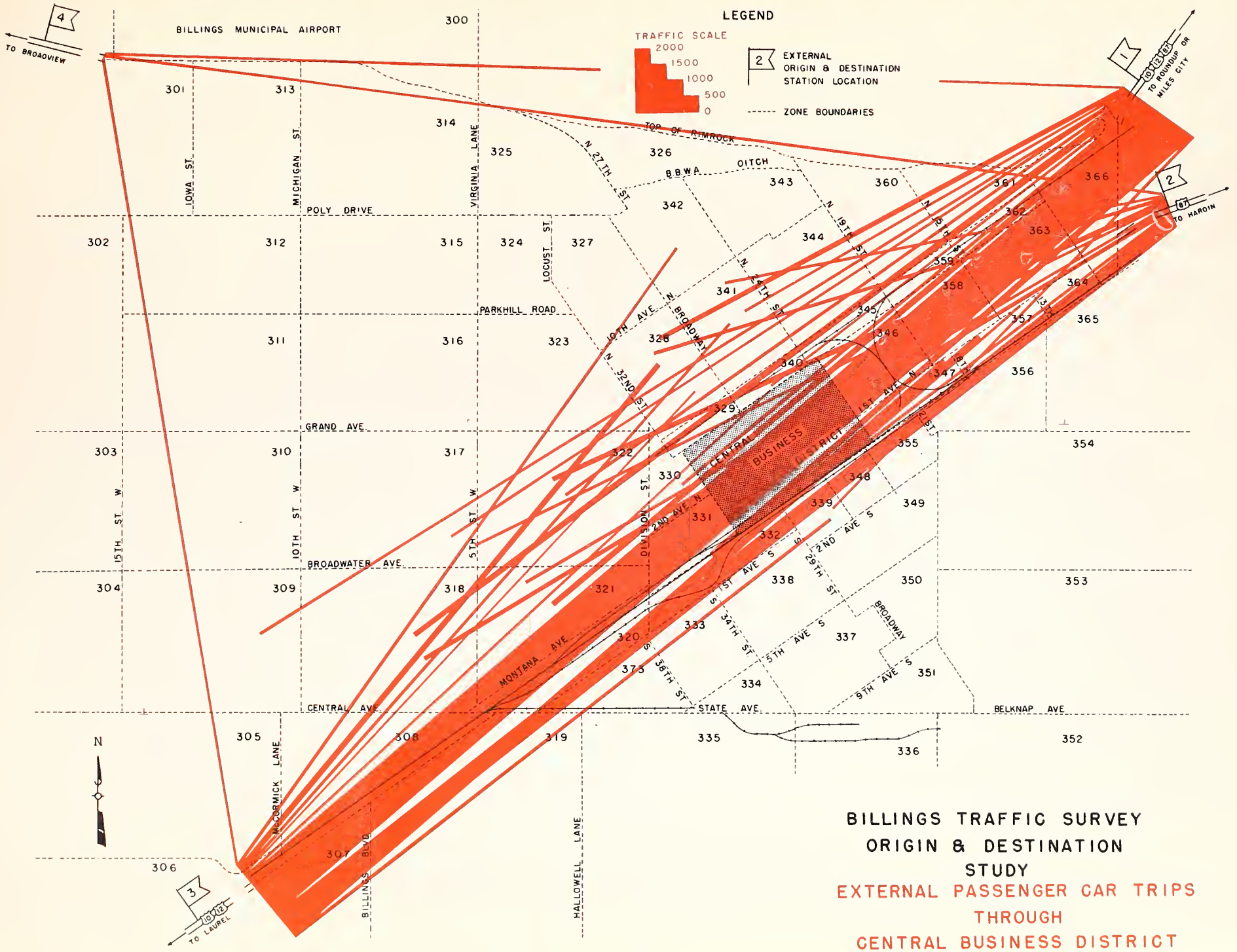
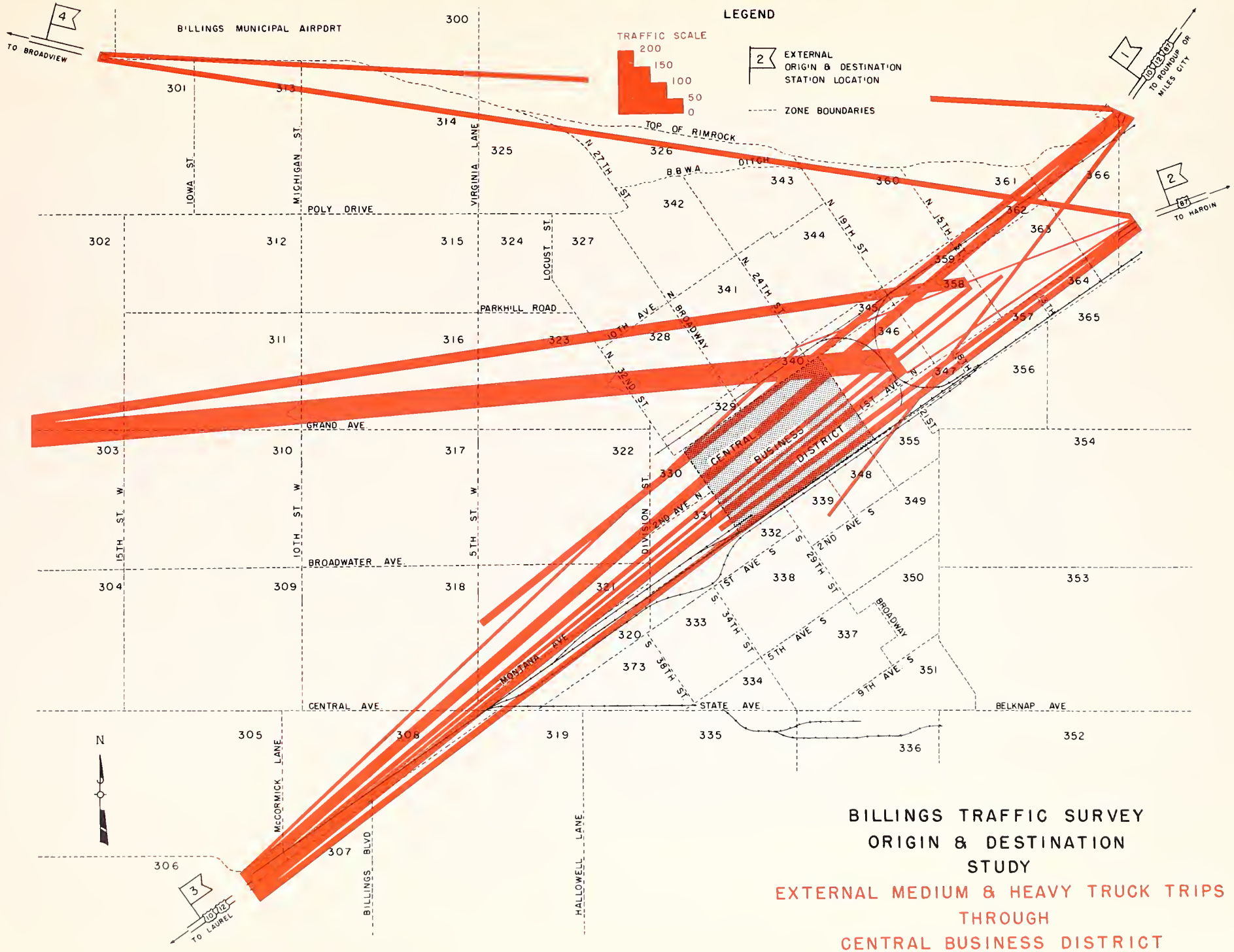


Plate 21

BILLINGS TRAFFIC SURVEY
ORIGIN & DESTINATION STUDY
EXTERNAL PASSENGER CAR TRIPS THROUGH CENTRAL BUSINESS DISTRICT

EXTERNAL MEDIUM AND HEAVY TRUCK TRIPS THROUGH THE CENTRAL BUSINESS DISTRICT

Plate 22 illustrates the approximate desire lines of 562 medium and heavy truck trips that passed through the central business district from origins or destinations outside the metropolitan area. Approximately 15 per cent of these trips did not stop in the city. All of them could have theoretically by-passed the central business district. This segment of traffic represents 1 per cent of the total volume crossing the inner cordon line on an average weekday in July 1954.

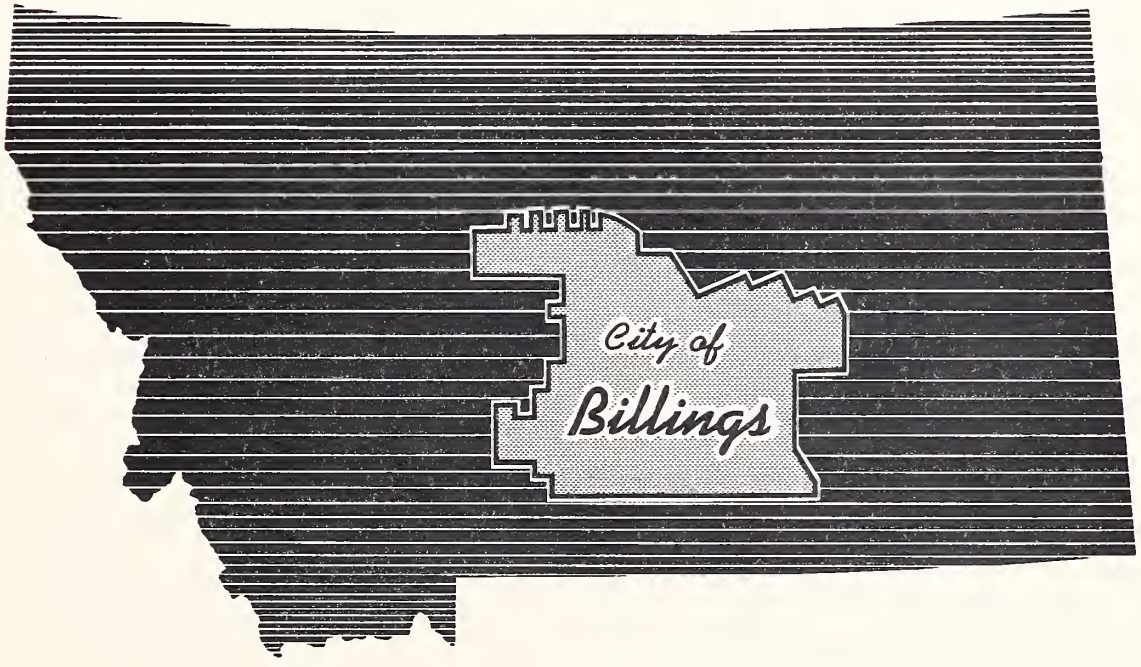


BILLINGS TRAFFIC SURVEY
ORIGIN & DESTINATION
STUDY
EXTERNAL MEDIUM & HEAVY TRUCK TRIPS
THROUGH
CENTRAL BUSINESS DISTRICT

Plate 22

Part Three

External



Origin & Destination

Survey

EXTERNAL ORIGIN AND DESTINATION SURVEY

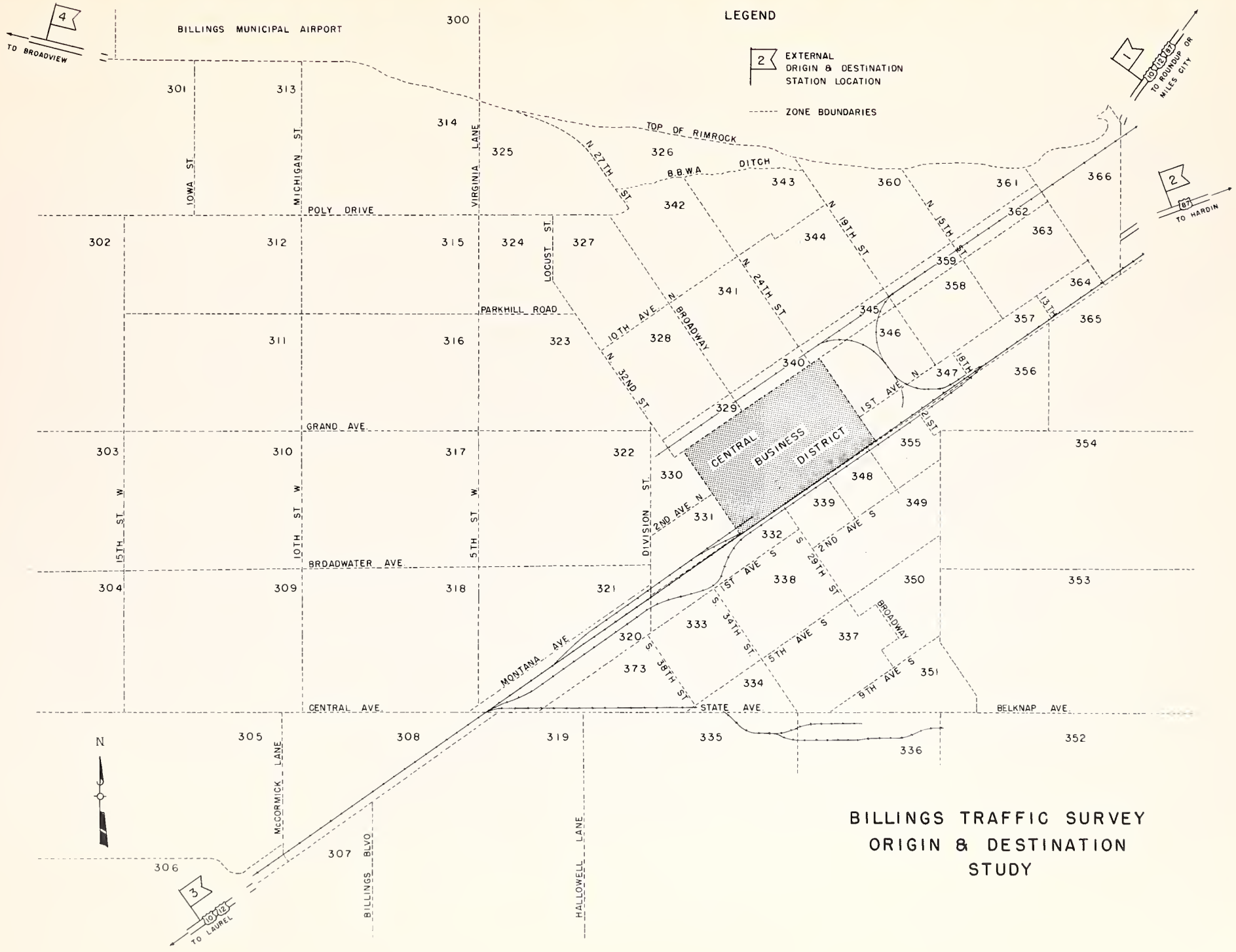
The inner cordon type of Origin and Destination Survey only sampled traffic that crossed an imaginary line surrounding the business district of Billings. Traffic that did not originate in or pass through the business district was missed. In order to complete the pattern of traffic movements in the Billings metropolitan area it was necessary to operate four external origin and destination stations on the principal highways near the city limits.

Each of the four stations was operated for a full 24 hours divided into three 8 hour shifts on alternate weekdays. Outbound motorists were stopped and interviewed concerning their origin, destination, principal stop in the City, and purpose of the stop. Manual classification counts were taken at all stations while the interviewing was in progress to provide the necessary expansion factors. Outbound traffic on an average weekday in July at the four stations totaled 12,919 vehicles of which 9,231 or 71 per cent were interviewed.

Identical zones were used in both the internal and external origin and destination surveys so that certain movements of traffic might be identified and grouped. The information from each interview was then prepared and processed on International Business Machine equipment.

A survey of this type can be used to determine the location and the volume of traffic that could use perimeter routes around an urban area. In this connection it was found that approximately 19 per cent of the total traffic entering and leaving Billings on an average weekday did not stop in the city.

The distribution of all traffic passing each external station is shown on the following plates..



BILLINGS TRAFFIC SURVEY
ORIGIN & DESTINATION STUDY

DISTRIBUTION OF ALL PASSENGER CAR AND LIGHT TRUCK TRIPS PASSING STATION 1

Plate 24 illustrates the distribution of all passenger car and light truck trips passing Station 1 in both directions on an average weekday in July 1954.

A summary of this traffic follows:

Average Weekday Traffic (Passenger Cars and Light Trucks)	6808
Per Cent of Total Traffic at Station	88
Per Cent of Total External Traffic	27
Per Cent to Central Business District	23
Per Cent to Other External Stations	19

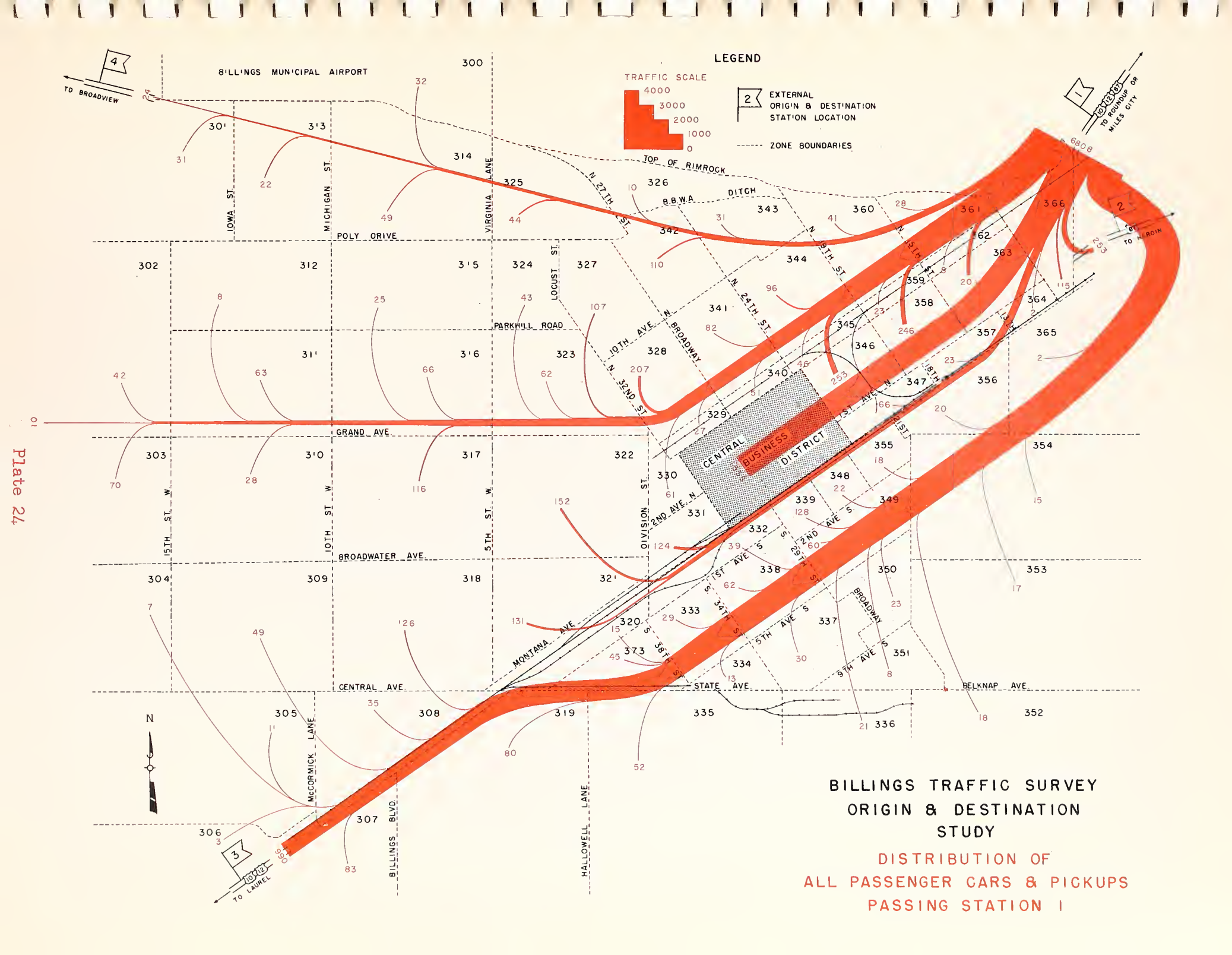

LEGEND
TRAFFIC SCALE
4000
3000
2000
1000
0
EXTERNAL ORIGIN & DESTINATION STATION LOCATION
ZONE BOUNDARIES
BILLINGS MUNICIPAL AIRPORT
TO BROADVIEW
TO ROUNDUP OR MILES CITY
TO LAUREL
TO ROMAIN
TOP OF RIMROCK
B.B.W.A. DITCH
POLY DRIVE
PARKHILL ROAD
GRAND AVE.
BROADWATER AVE.
CENTRAL AVE.
STATE AVE.
BELKNAP AVE.
MONTANA AVE.
CENTRAL BUSINESS DISTRICT
IOWA ST.
MICHIGAN ST.
VIRGINIA LANE
LOCUST ST.
N. 27TH ST.
N. 24TH ST.
N. 19TH ST.
N. 31ST ST.
10TH AVE. N.
BROADWAY
N. 32ND ST.
1ST AVE. N.
2ND AVE. N.
15TH ST. W.
10TH ST. W.
5TH ST. W.
DIVISION ST.
1ST AVE. S.
2ND AVE. S.
34TH ST.
38TH ST.
5TH AVE. S.
9TH AVE. S.
McCORMICK LANE
BILLINGS BLVD.
HALLOWELL LANE
BILLINGS TRAFFIC SURVEY
ORIGIN & DESTINATION STUDY
DISTRIBUTION OF ALL PASSENGER CARS & PICKUPS PASSING STATION 1

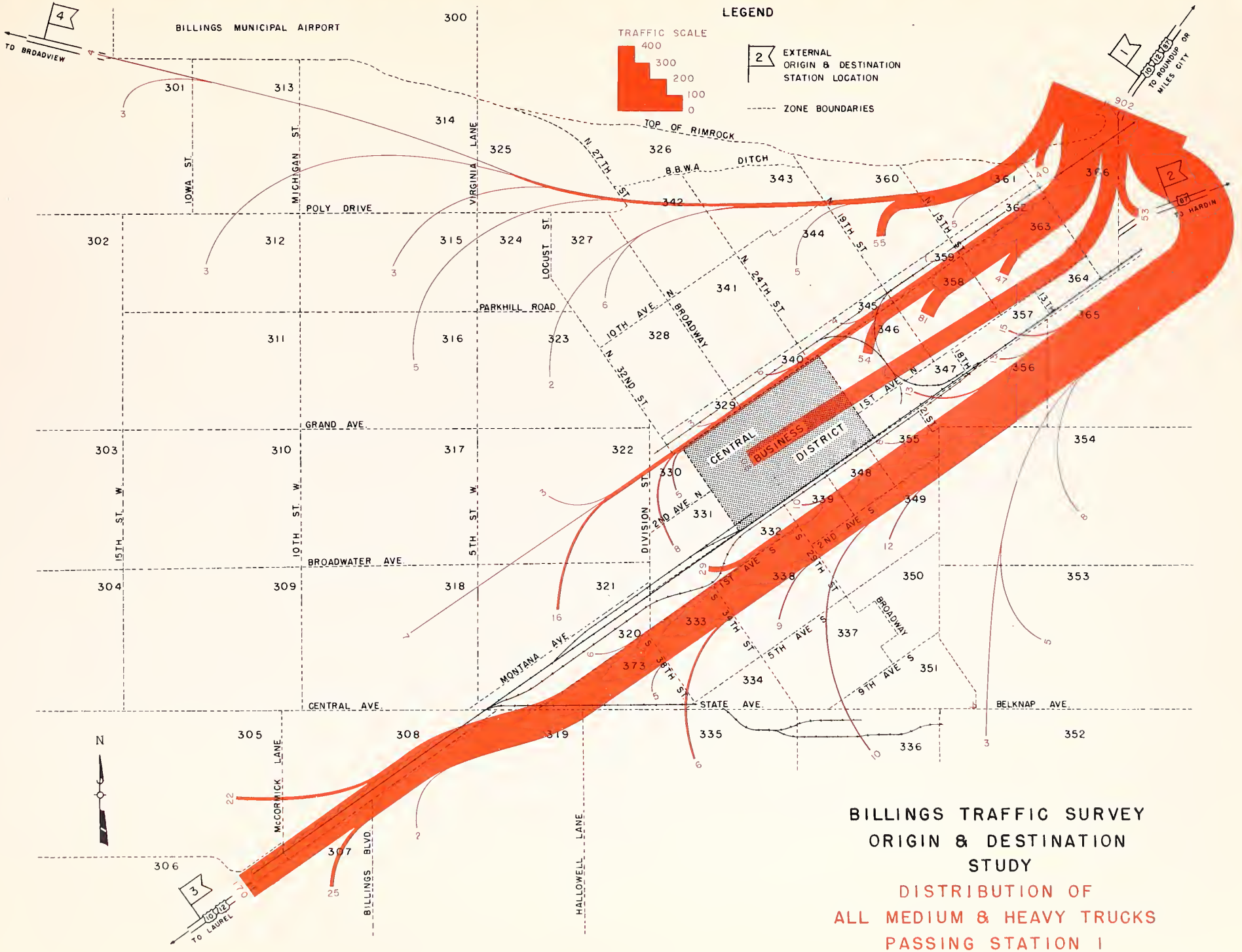
Plate 24

DISTRIBUTION OF ALL MEDIUM AND HEAVY TRUCK TRIPS PASSING STATION 1

Plate 25 illustrates the distribution of all medium and heavy truck trips passing Station 1 in both directions on an average weekday in July 1954.

A summary of this traffic follows:

Average Weekday Traffic (Medium and Heavy Trucks)	902
Per Cent of Total Traffic at Station	12
Per Cent of Total External Commercial Traffic	33
Per Cent to Central Business District	12
Per Cent to Other External Stations	25



BILLINGS TRAFFIC SURVEY
ORIGIN & DESTINATION STUDY

DISTRIBUTION OF ALL MEDIUM & HEAVY TRUCKS PASSING STATION 1

Plate 25

DISTRIBUTION OF ALL PASSENGER CAR AND LIGHT TRUCK TRIPS PASSING STATION 2

Plate 26 illustrates the distribution of all passenger car and light truck trips passing Station 2 in both directions on an average weekday in July 1954.

A summary of this traffic follows:

Average Weekday Traffic (Passenger Cars and Light Trucks)	4844
Per Cent of Total Traffic at Station	87
Per Cent of Total External Traffic	19
Per Cent to Central Business District	21
Per Cent to Other External Stations	15

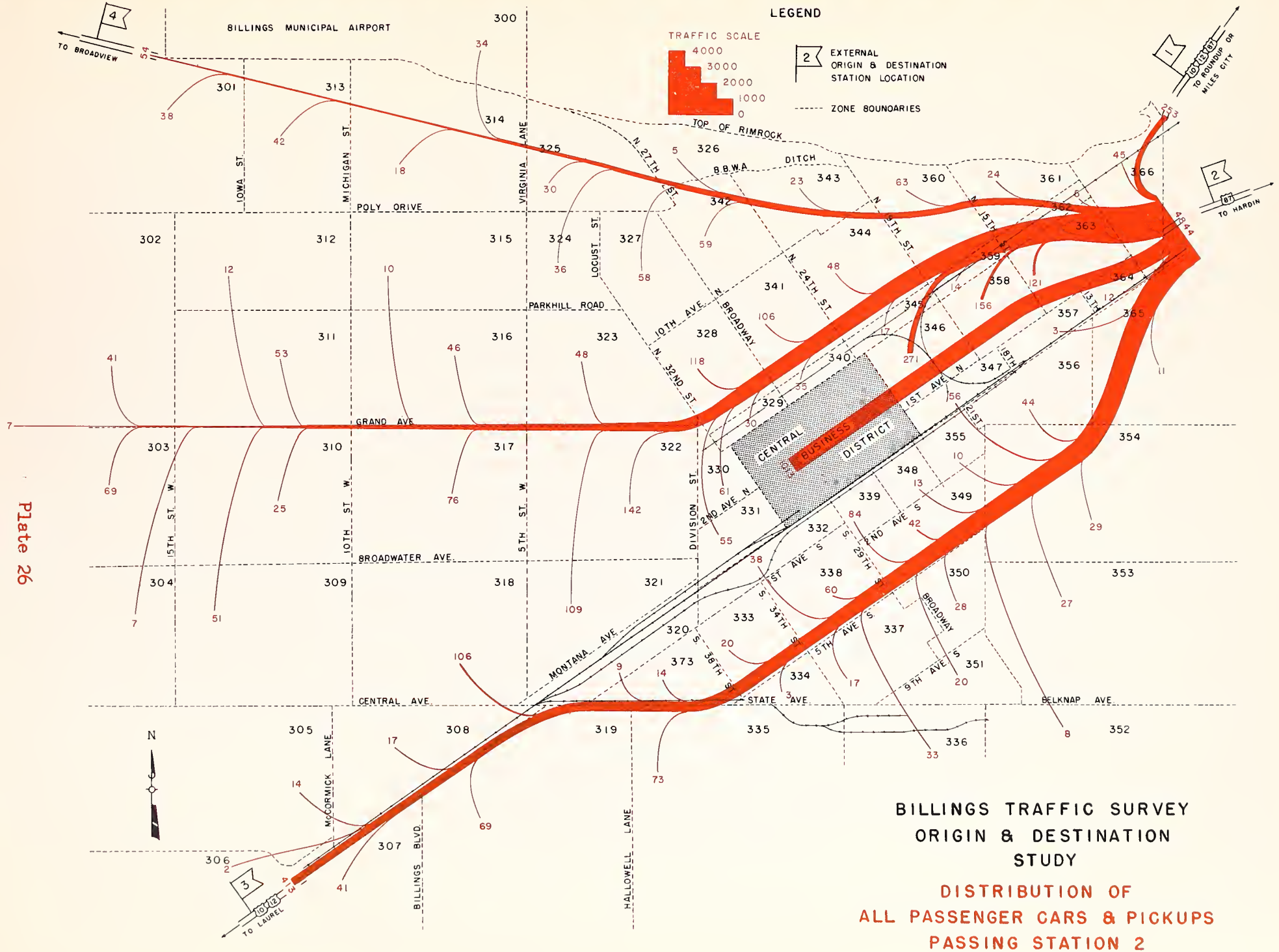


Plate 26

BILLINGS TRAFFIC SURVEY
ORIGIN & DESTINATION STUDY

DISTRIBUTION OF ALL PASSENGER CARS & PICKUPS PASSING STATION 2

DISTRIBUTION OF ALL MEDIUM AND HEAVY TRUCK TRIPS PASSING STATION 2

Plate 27 illustrates the distribution of all medium and heavy truck trips passing Station 2 in both directions on an average weekday in July 1954.

A summary of this traffic follows:

Average Weekday Traffic (Medium and Heavy Trucks)	708
Per Cent of Total Traffic at Station	13
Per Cent of Total External Commercial Traffic	25
Per Cent to Central Business District	9
Per Cent to Other External Stations	23

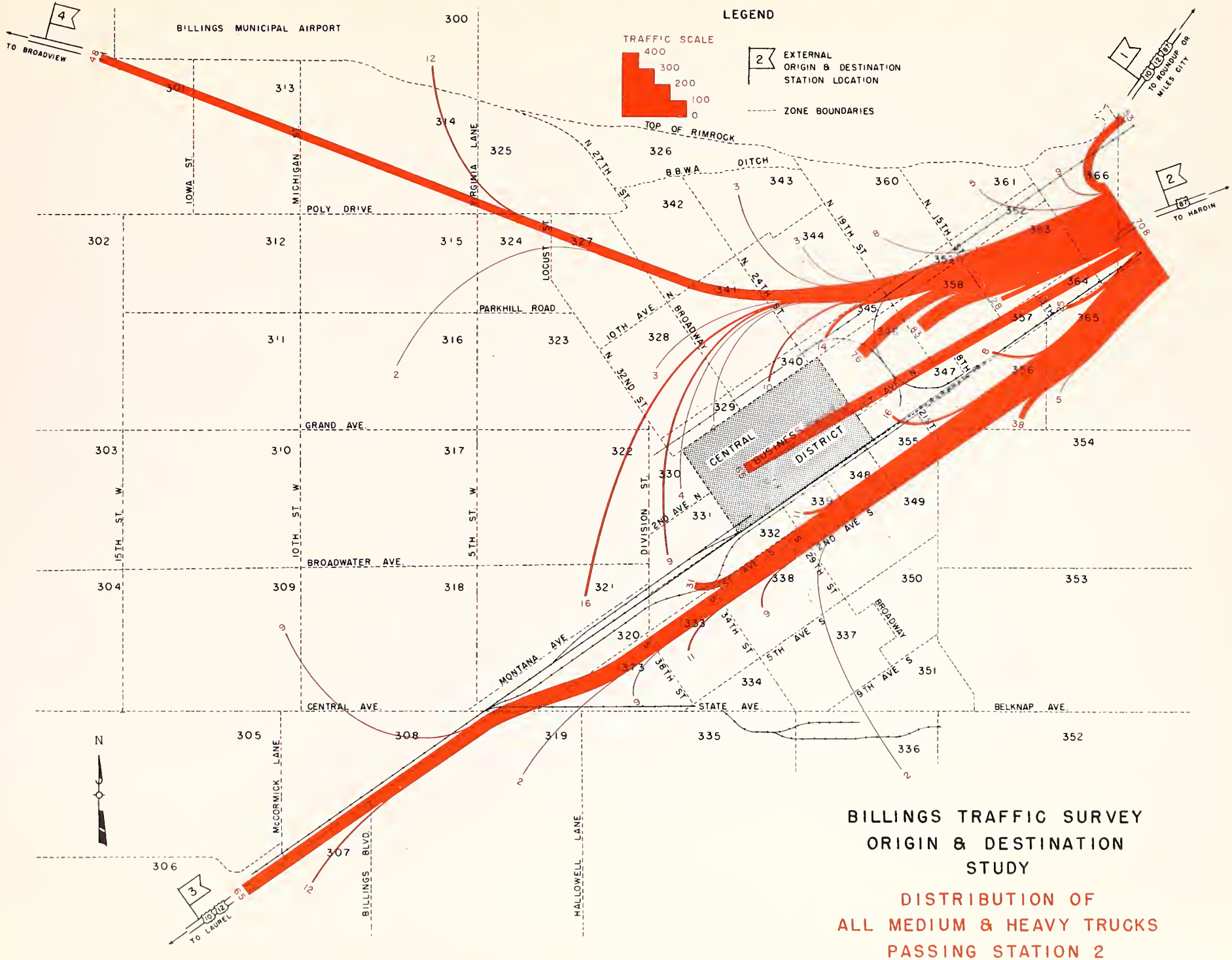


Plate 27

BILLINGS TRAFFIC SURVEY
ORIGIN & DESTINATION STUDY

DISTRIBUTION OF ALL MEDIUM & HEAVY TRUCKS PASSING STATION 2

DISTRIBUTION OF ALL PASSENGER CAR AND LIGHT TRUCK TRIPS PASSING STATION 3

Plate 28 illustrates the distribution of all passenger car and light truck trips passing Station 3 in both directions on an average weekday in July 1954.

A summary of this traffic follows:

Average Weekday Traffic (Passenger Cars and Light Trucks)	9635
Per Cent of Total Traffic at Station	91
Per Cent of Total External Traffic	39
Per Cent to Central Business District	20
Per Cent to Other External Stations	15

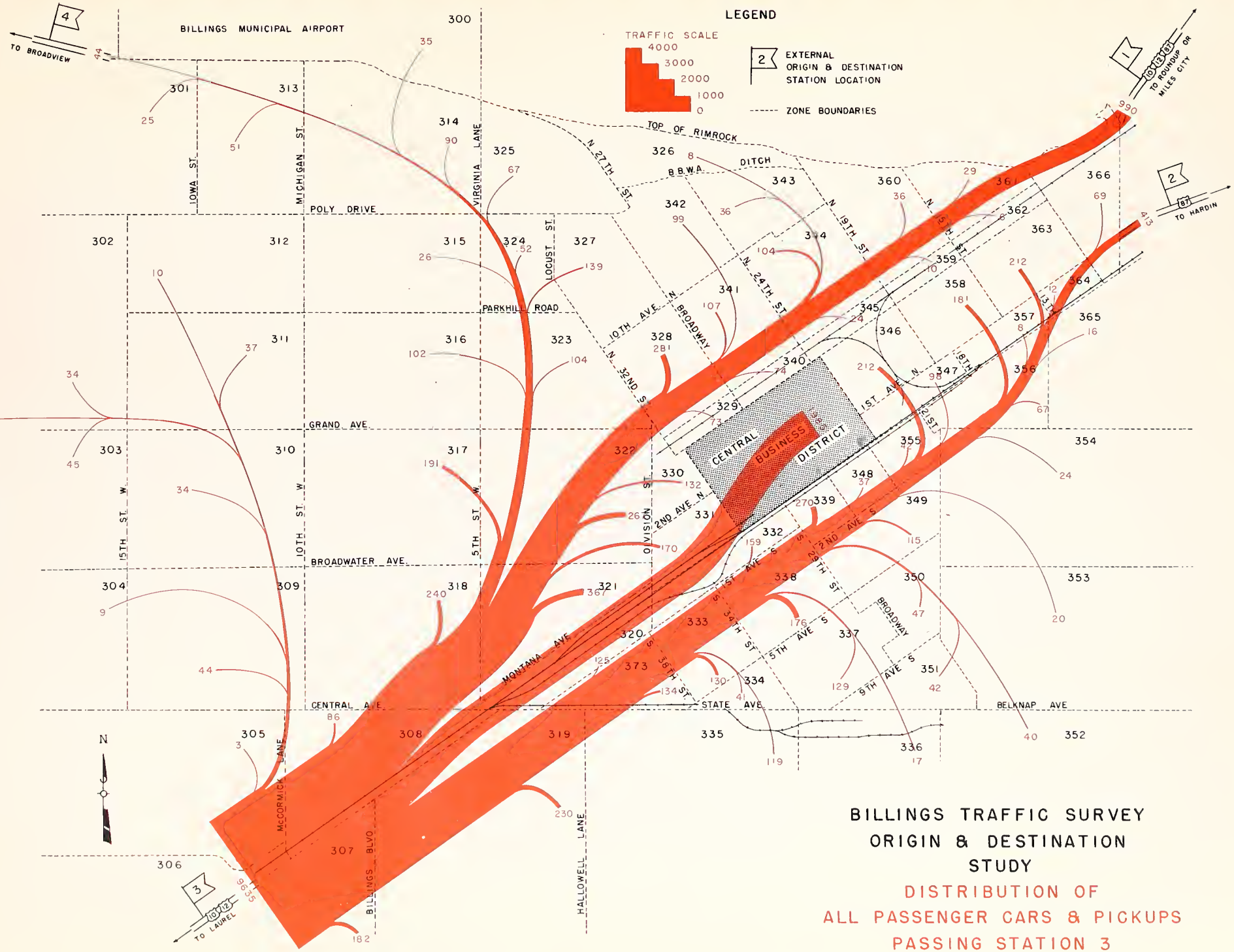


Plate 28

BILLINGS TRAFFIC SURVEY
ORIGIN & DESTINATION STUDY

DISTRIBUTION OF ALL PASSENGER CARS & PICKUPS PASSING STATION 3

DISTRIBUTION OF ALL MEDIUM AND HEAVY TRUCK TRIPS PASSING STATION 3

Plate 29 illustrates the distribution of all medium and heavy truck trips passing Station 3 in both directions on an average weekday in July 1954.

A summary of this traffic follows:

Average Weekday Traffic (Medium and Heavy Trucks)	971
Per Cent of Total Traffic at Station	9
Per Cent of Total External Commercial Traffic	35
Per Cent to Central Business District	10
Per Cent to Other External Stations	26

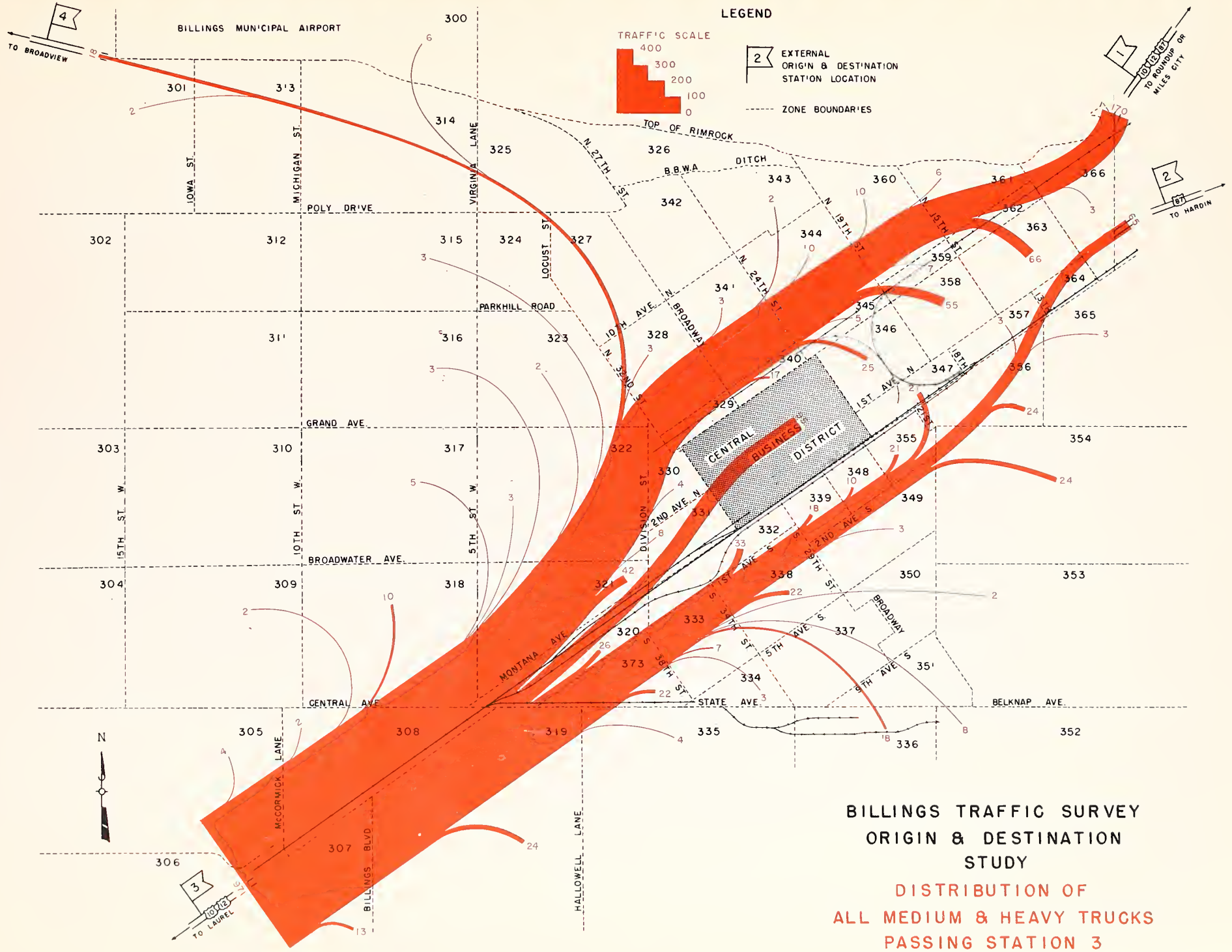


Plate 29

BILLINGS TRAFFIC SURVEY
ORIGIN & DESTINATION STUDY

DISTRIBUTION OF ALL MEDIUM & HEAVY TRUCKS PASSING STATION 3

DISTRIBUTION OF ALL PASSENGER CAR AND LIGHT TRUCK TRIPS PASSING STATION 4

Plate 30 illustrates the distribution of all passenger car and light truck trips passing Station 4 in both directions on an average weekday in July 1954.

A summary of this traffic follows:

Average Weekday Traffic (Passenger Cars and Light Trucks)	950
Per Cent of Total Traffic at Station	83
Per Cent of Total External Traffic	4
Per Cent to Central Business District	19
Per Cent to Other External Stations	13

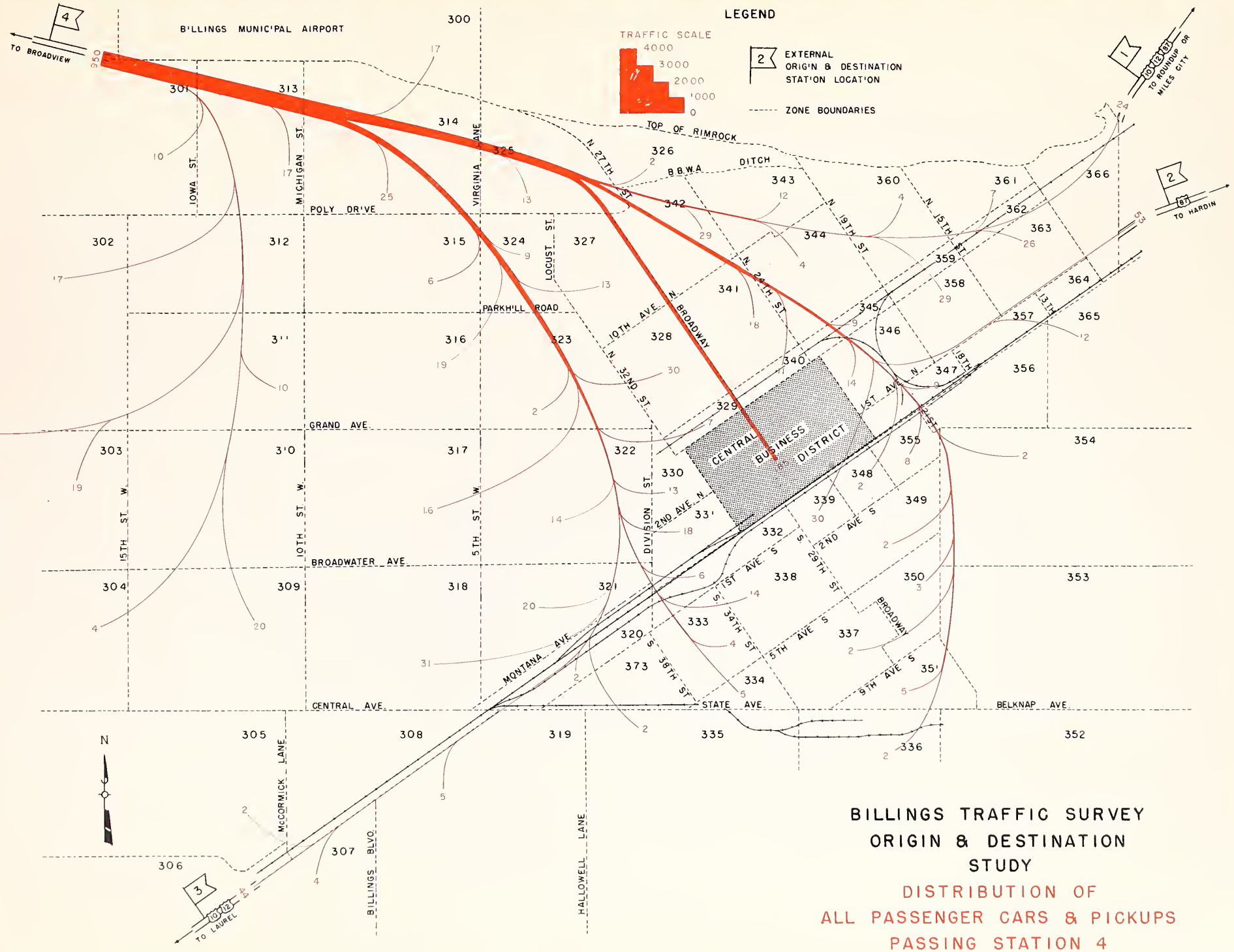


Plate 30

BILLINGS TRAFFIC SURVEY
ORIGIN & DESTINATION STUDY

DISTRIBUTION OF ALL PASSENGER CARS & PICKUPS PASSING STATION 4

DISTRIBUTION OF ALL MEDIUM AND HEAVY TRUCK TRIPS PASSING STATION 4

Plate 31 illustrates the distribution of all medium and heavy truck trips passing Station 4 in both directions on an average weekday in July 1954.

A summary of this traffic follows:

Average Weekday Traffic (Medium and Heavy Trucks)	194
Per Cent of Total Traffic at Station	17
Per Cent of Total External Commercial Traffic	7
Per Cent to Central Business District	6
Per Cent to Other External Stations	37

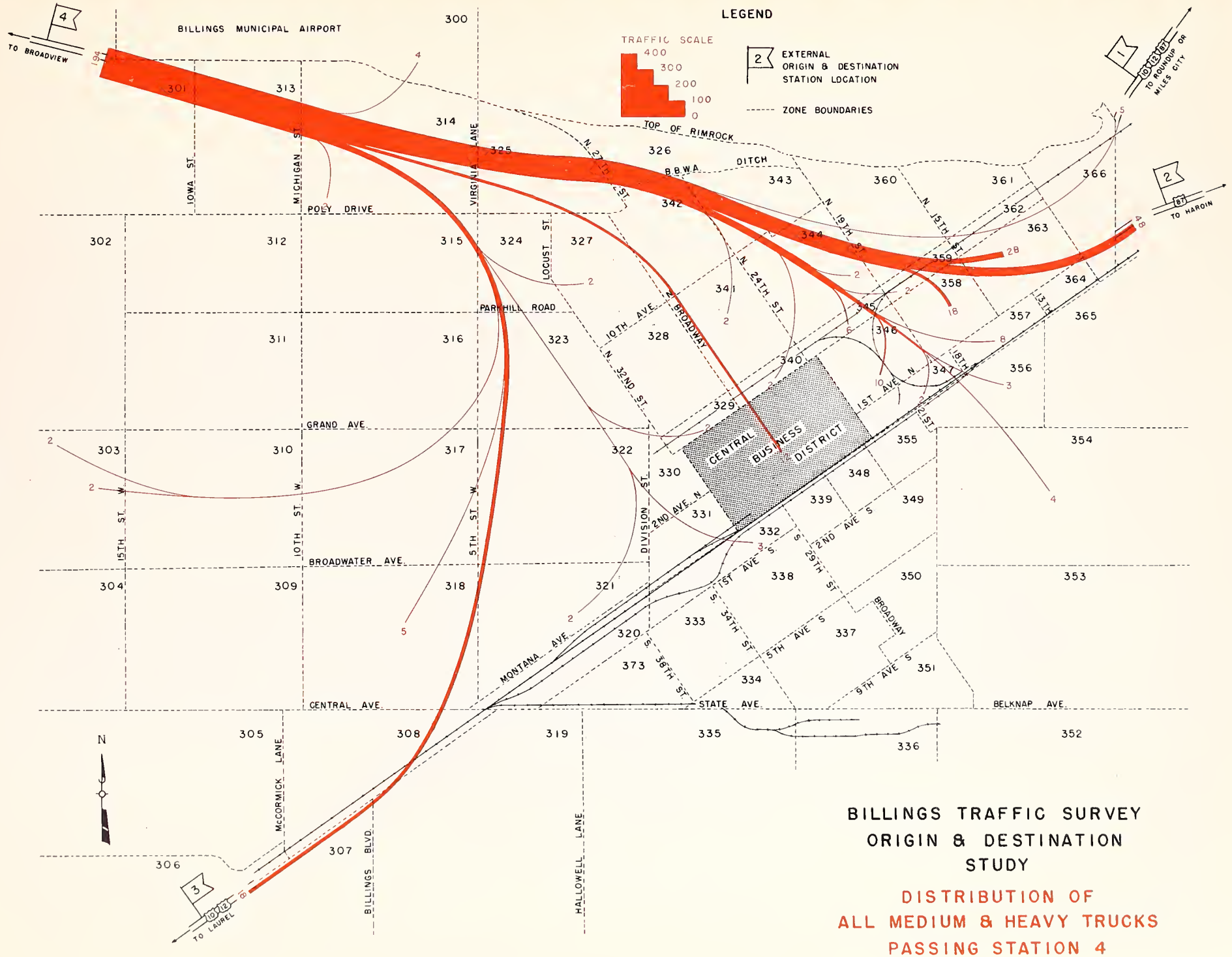


Plate 31

BILLINGS TRAFFIC SURVEY
ORIGIN & DESTINATION STUDY

DISTRIBUTION OF ALL MEDIUM & HEAVY TRUCKS PASSING STATION 4

DISTRIBUTION OF ALL THROUGH TRAFFIC

Plate 32 illustrates the interchange between external stations of all through trips on an average weekday in July 1954.

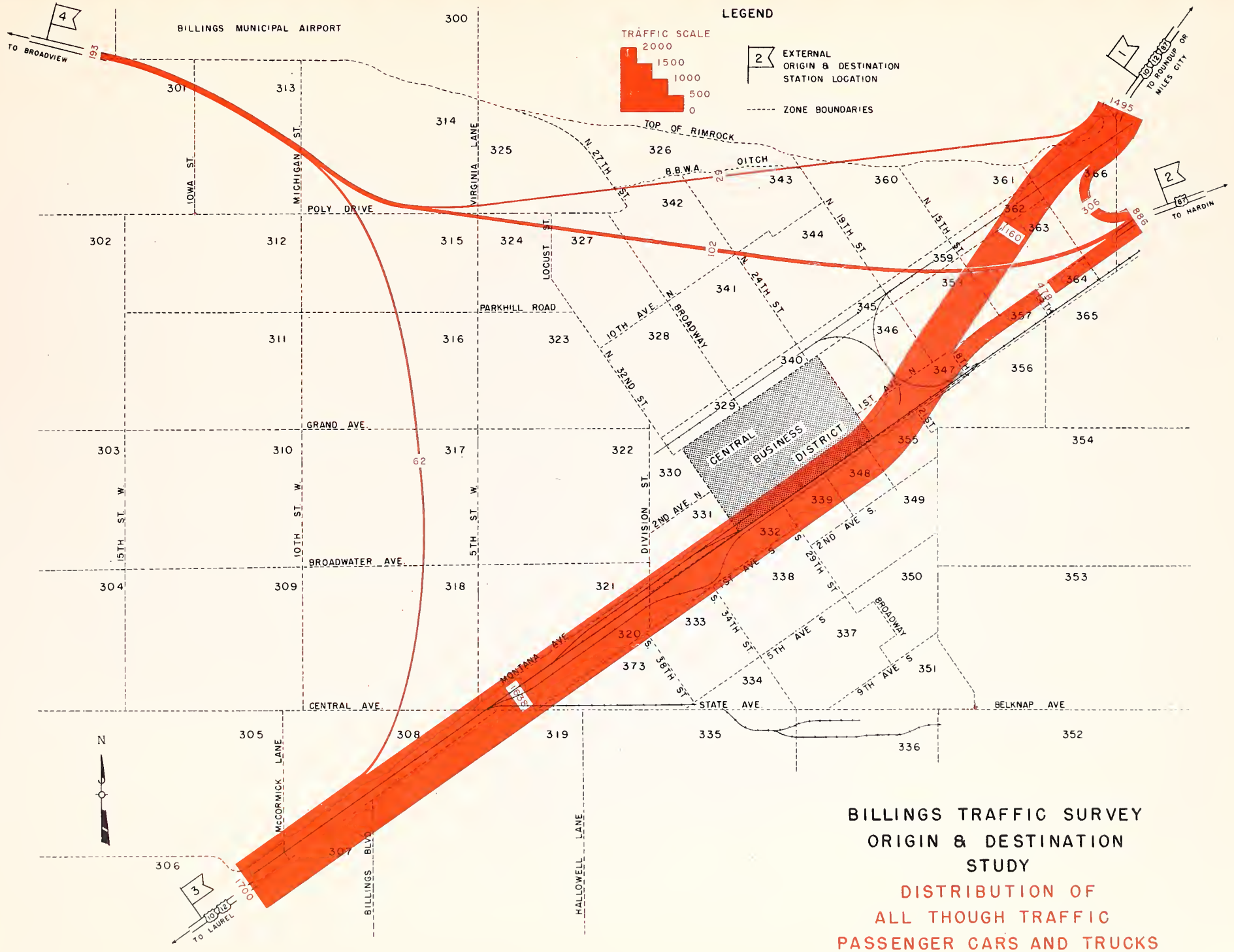
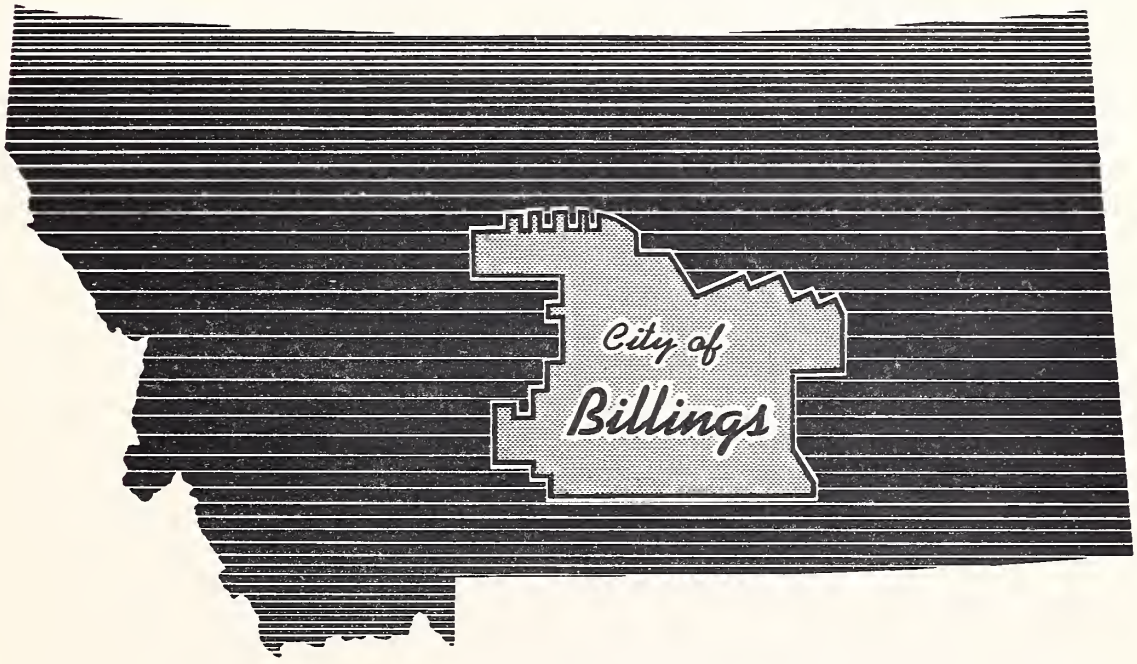


Plate 32

BILLINGS TRAFFIC SURVEY
ORIGIN & DESTINATION STUDY

DISTRIBUTION OF ALL THOUGH TRAFFIC PASSENGER CARS AND TRUCKS

Part Four



Parking Study

PARKING STUDY

Where to find a place to park in the central business district has become one of the major headaches of the motorist in most cities of any size. As a city develops, more and more vacant space that formerly could be used for off street parking is necessarily removed from this purpose by the construction of commercial buildings. These new buildings in turn create more parking demand in the constant vicious circle. The problem of providing adequate parking in the central business district must be first realized and then solved by any city that has plans for future growth. Before the problem can be solved, however, a study must be made of the existing parking supply, the present use of this supply and the probable demand.

PARKING SUPPLY

An inventory of all parking spaces both public and private within the inner cordon area in Billings is shown on Plate 33. A summary of all parking spaces within the area is as follows:

METERED CURB					FREE CURB				LOTS			GARAGES	GRAND TOTAL
2 Hr.	1 Hr.	36 Min.	12 Min.	Total	Unrestricted	2 Hr.	10 Min.	Total	Metered	Others	Total		
540	131	130	71	872	803	129	13	945	306	1103	1409	59	3285

The city of Billings had four municipally operated metered lots with a total capacity of 306 vehicles in use at the time of the inventory. A fifth lot with a capacity of 44 vehicles was under construction and is now in use.

PARKING DEMAND

The results of the parking portion of the internal origin and destination

survey indicate that approximately 12,800 vehicles park within the central business district of Billings during the hours of 10 A.M. to 6 P.M. on an average weekday in July. The block containing the Hart-Albin Department Store was given the most times in answer to questioning concerning the origin of the trip.

The following tabulation was compiled from parking data obtained in conjunction with the origin and destination study:

AVERAGE TIME PARKED

Trip Purpose	Per Cent	Curb			Off Street			All Parking	
		Hrs.	Min.	Per Cent	Hrs.	Min.	Per Cent	Hours	Minutes
Work or Business	59	-	48	71	2	42	29	1	11
Shopping	19	-	38	75	-	57	25	-	42
Social or Recreational	16	-	59	71	2	35	29	1	27
Medical	2	-	50	75	1	59	25	1	4
Other	4	-	46	72	2	20	28	1	12
All Purposes	100	-	48	72	2	13	28	1	12

Manual directional traffic counts were taken on weekdays and Saturday at all stations on the cordon line enclosing the central business district. These counts were analyzed to determine the peak hour of vehicle accumulation within the area on both weekdays and Saturday. It was found that the peak hour of vehicle accumulation occurred between 10 and 11 A.M. on both weekdays and Saturday and held at a comparatively high level from 10 A.M. to 5 P.M. on weekdays. The Saturday peak hour was slightly higher than on weekdays but a large number of vehicles apparently left the downtown area at noon and did not return in the afternoon.

A spot check was then made by cruising the area during the peak hours and actually counting the number of vehicles parked at the curb, in lots, alleys, service stations, etc.

The following spot count tabulation is an indication of how acute the parking situation is during the peak hour:

NUMBER OF VEHICLES PARKED IN AREA

	Curb		Lots		Garages		Alleys, etc.		Total	
	Vehicles Parked	Capacity	Vehicles Parked	Capacity	Vehicles Parked	Capacity	Vehicles Parked	Capacity	Vehicles Parked	Capacity
Fri.10-11A.M.	1623	1817	847	1409	27	59	165	-	2662	3285
Sat.10-11A.M.	1724	1817	823	1409	23	59	265	-	2835	3285

The total number of vehicles that were found parked in the 49 block area represents 81 per cent of the legal capacity of both curb and off street parking on Friday and 86 per cent on Saturday. In a twenty block area on Saturday all legal curb spaces were filled and there were 61 vehicles illegally parked in end zones, at fire plugs, in loading zones, etc. The scope of the illegal curb parking in the core of the business district combined with the fact that curb parking in the entire 49 block area was 95 per cent of legal capacity indicates a critical parking situation exists during peak hours.

An analysis made of space hour demand compiled from data obtained from the origin and destination data reveals a shortage of approximately 2600 space hours in a nine block core area during the hours of 10 A.M. - 6 P.M. The reduction of space hours to 8 hour parking spaces results in an estimated deficit of over 300 spaces in the core area during business hours. These spaces preferably should be located within a maximum walking distance of 450 - 500 feet from the principal business frontage as shown on Plates 36 and 37.

MUNICIPALLY OPERATED PARKING LOTS

The four metered public lots under city operation during the survey

were filled to an average of 49 per cent of capacity during the peak hour on Saturday and 35 per cent on Friday. Curb parking during the same hours was found to be 95 per cent and 90 per cent respectively of capacity in the entire 49 block area.

This condition indicates that maximum use is not being made of the existing off street parking facilities. This can be attributed to some extent to the relatively high rate of 10 cents per hour now being charged for use of three of the lots located on the fringe of the business district.

A summary of the four metered lots that were in operation during the survey follows:

Peak Hour 10-11 A.M. Saturday, July 24, 1954

Location (Block No.)	Walking Distance from 2nd Avenue North and 28th Street	Rate Per Hour	Capacity	Vehicle Count	Per Cent Utilized
512	960 Feet	10 Cents	104	27	26
515	990 Feet	10 Cents	51	37	72
516	1250 Feet	5 Cents	84	35	42
521	900 Feet	10 Cents	67	51	76
Totals			306	150	49

As a comparison to Billings, Alhambra, California with a 1950 population of 54,000 is now operating 13 municipally owned, metered, parking lots having a total capacity of 732 vehicles. During 1954, spaces in the 13 metered lots were 84 per cent utilized during business hours at rates varying from 5 cents per hour near the center of the business district to two hours for 5 cents on lots located over 500 feet from the business district. Total revenue from the 732 meters has been approximately $45,000 per year or over $61.00 per meter. In Billings the average revenue per meter for 1954 was $120.00 but the per cent of utilization for the year was only 55 per cent during business hours six days per week. This indicates that at the present rates motorists will not park in the off street lots until the curb parking

has been almost completely filled.

If present rental agreements now in effect on the municipal parking lots preclude any reduction in rates, it is suggested that some arrangement might be made with the downtown merchants whereby they would subsidize a portion of the rental. In a recent U.S. Chamber of Commerce publication it has been estimated that one off street parking stall having an average daily turnover of three cars can be conservatively valued at a minimum of $10,000 in annual retail sales. More optimistic estimates in the same publication place this value as high as $50,000 in terms of annual retail sales.

CURB PARKING TURNOVER

In connection with the present use of available curb parking, a study was made to determine the parking turnover on four representative blocks in the business district.

Data on the parking turnover on each block were obtained by a recorder who inventoried the vehicles parked at the curb and noted license numbers every 15 minutes between the hours of 10 A.M. and 6 P.M. By this method the parking turnover could be determined as well as related facts such as average time parked, number of meter violations, etc. The results of this special study are shown on Plates 39 to 42 inclusive.

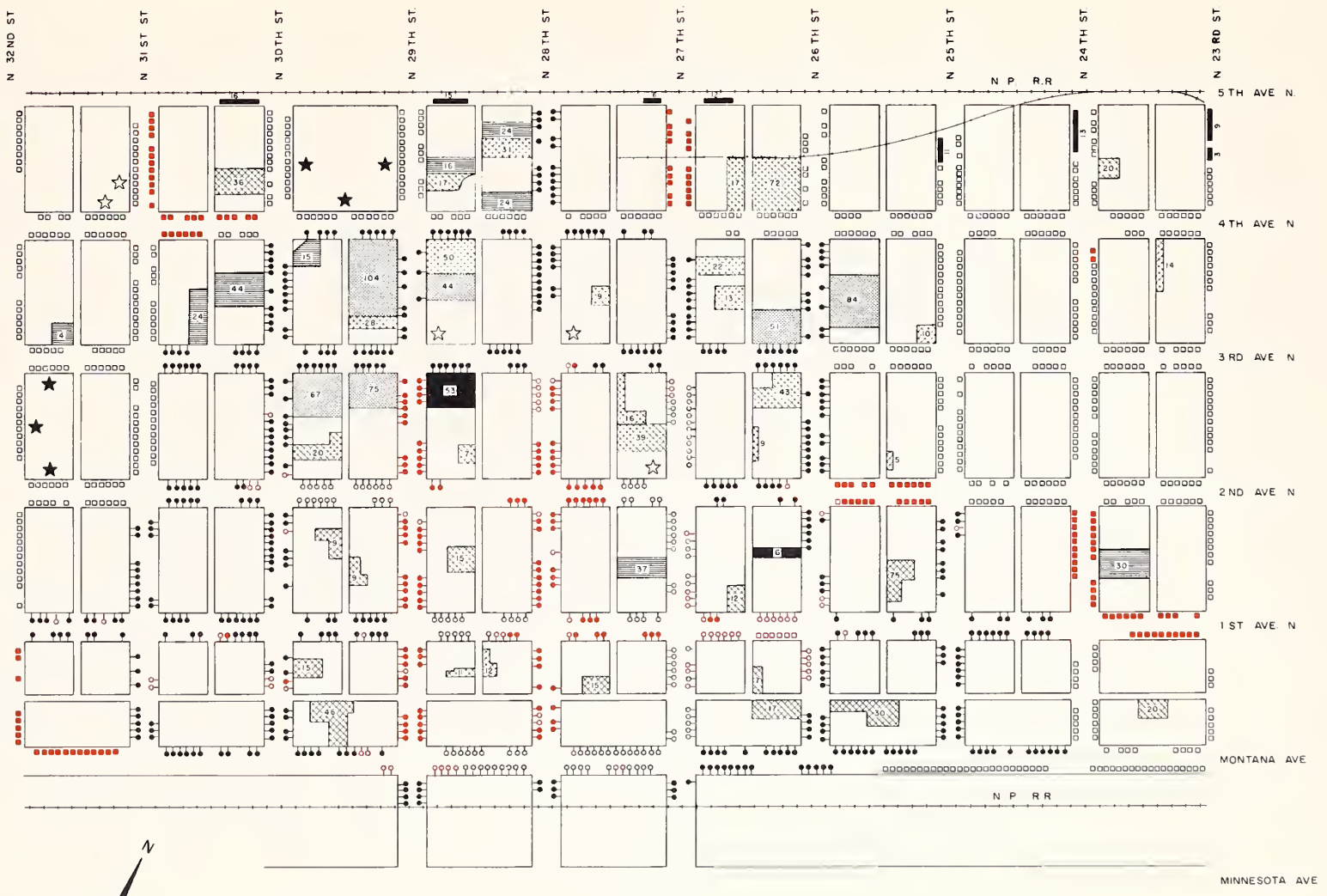
In the four blocks that were inventoried, it was found that only 17 per cent of the total number of vehicles parked for over one hour but they used 54 per cent of the total space hours available at the curb. The maximum time parked ranged from 5 ¾ to 8 hours with a substantial amount of the total time in meter violation.

It is suggested that a concentrated enforcement effort directed against the few long time curb parkers in the core of the business district will result in a substantial increase in parking space available for the average motorist who parks less than one hour.

Plate 33

BILLINGS TRAFFIC SURVEY
LOCATION AND PARKING CAPACITY
OF STREETS, LOTS AND GARAGES

AS OF JULY 1954



LEGEND

OFF STREET PARKING

- PUBLIC LOTS
- PRIVATE LOTS
- CUSTOMER LOTS
- PUBLIC GARAGES

NOTE: NUMBERS SHOW CAPACITY OF LOTS, GARAGES AND ANGLE STREET PARKING.

STREET-FREE PARKING

- UNRESTRICTED
- UNRESTRICTED (ANGLE)
- 10 MINUTES RESTRICTED
- 2 HOUR RESTRICTED

STREET-METERED PARKING

- 1 HOUR
- 2 HOUR
- 12 MINUTE
- 36 MINUTE

NOTES

☆ = NO PARKING, BUILDING CONSTRUCTION

★ = NO PARKING ON SCHOOL DAYS

BILLINGS TRAFFIC SURVEY
ALL VEHICLES ENTERING OR LEAVING CORDON AREA
AVERAGE WEEKDAY - JULY 1954
6 A.M. - 6 P.M.

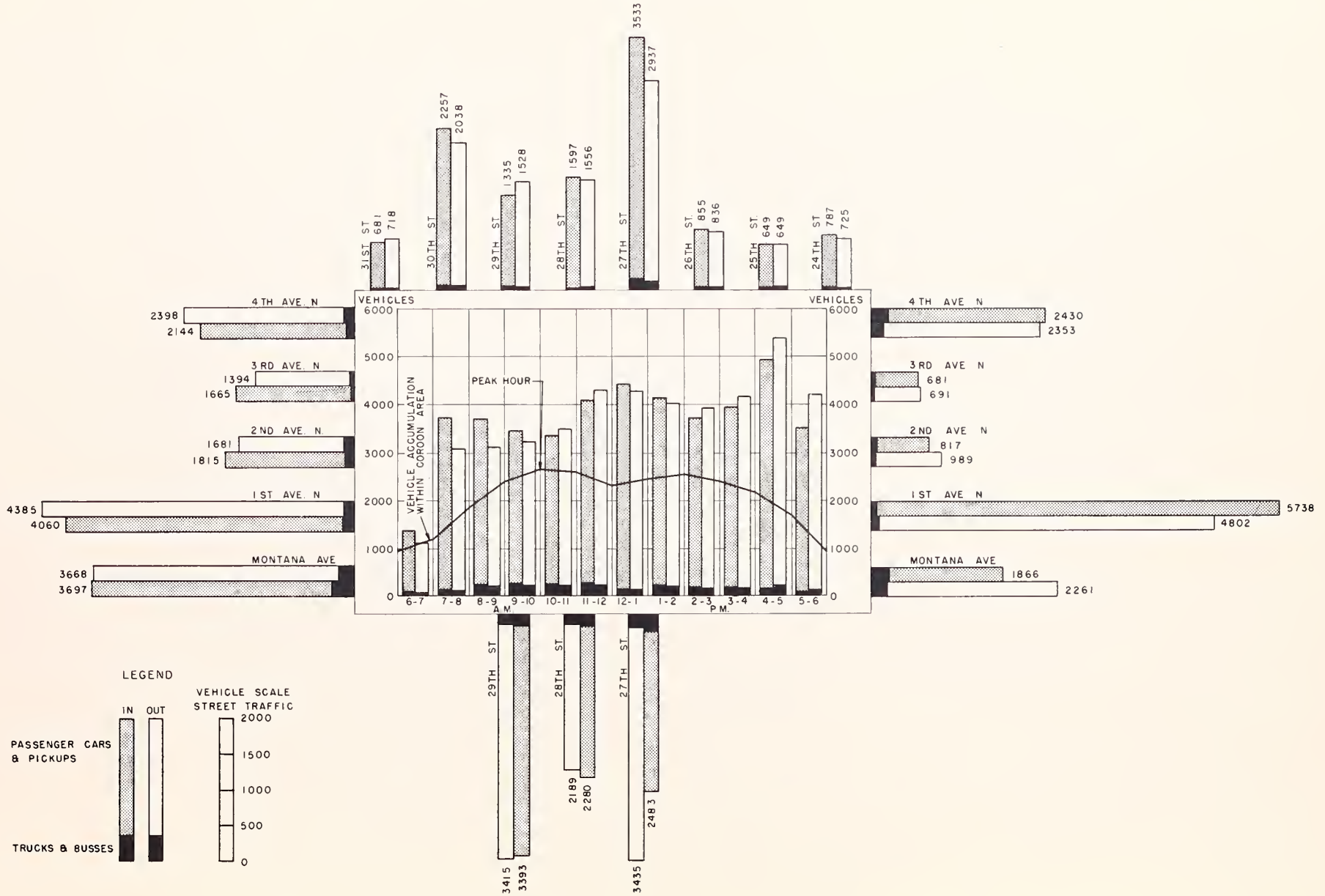
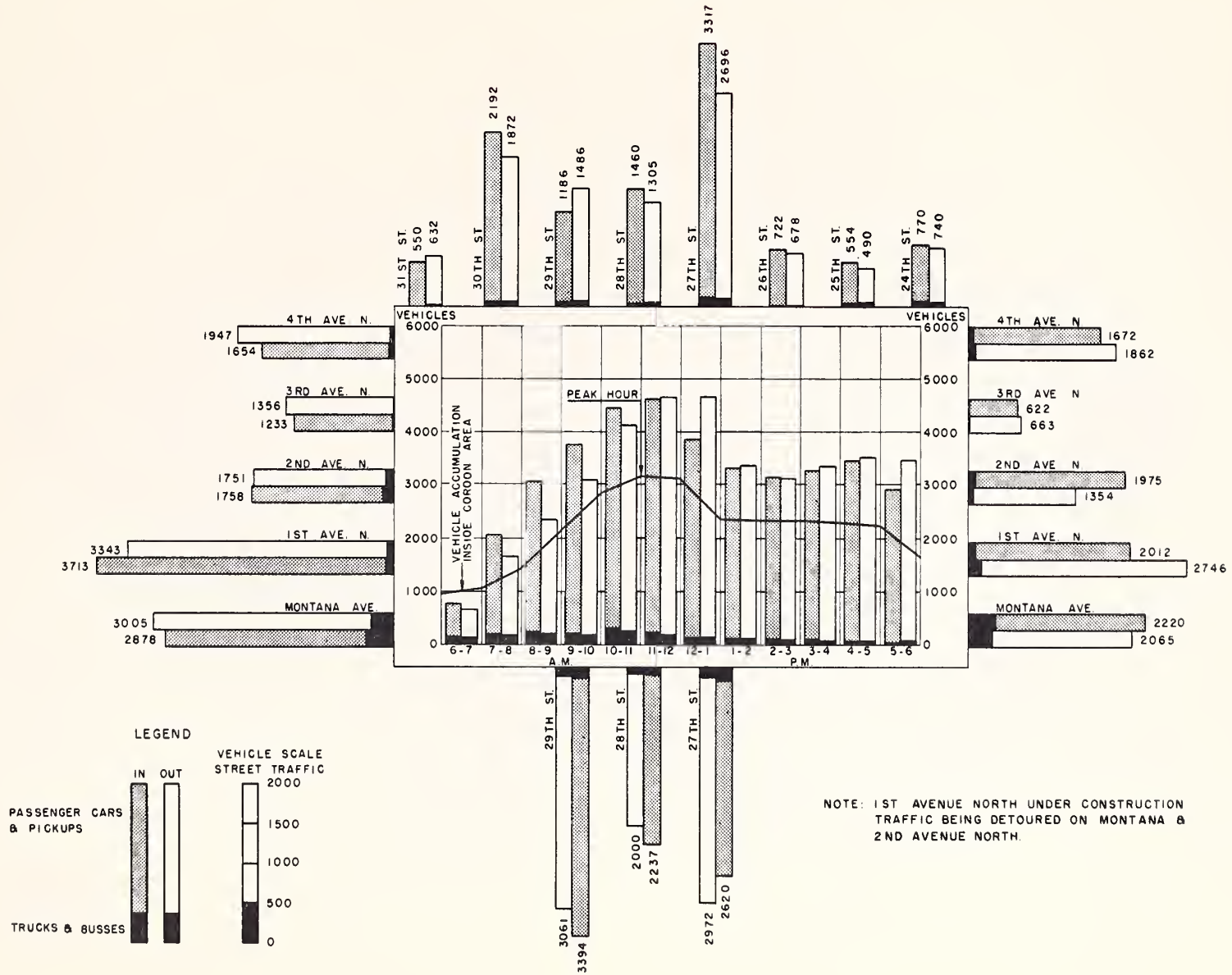


Plate 34

BILLINGS TRAFFIC SURVEY
ALL VEHICLES ENTERING OR LEAVING CORDON AREA
SATURDAY - JULY 24, 1954
6 A.M. - 6 P.M.



NOTE: 1ST AVENUE NORTH UNDER CONSTRUCTION TRAFFIC BEING DETOURED ON MONTANA & 2ND AVENUE NORTH.

Plate 35

BILLINGS TRAFFIC SURVEY
CURB SPACE & PARKING LOT OCCUPANCY
FRIDAY JULY 23, 1954 - 10:00 TO 11:00 A.M.

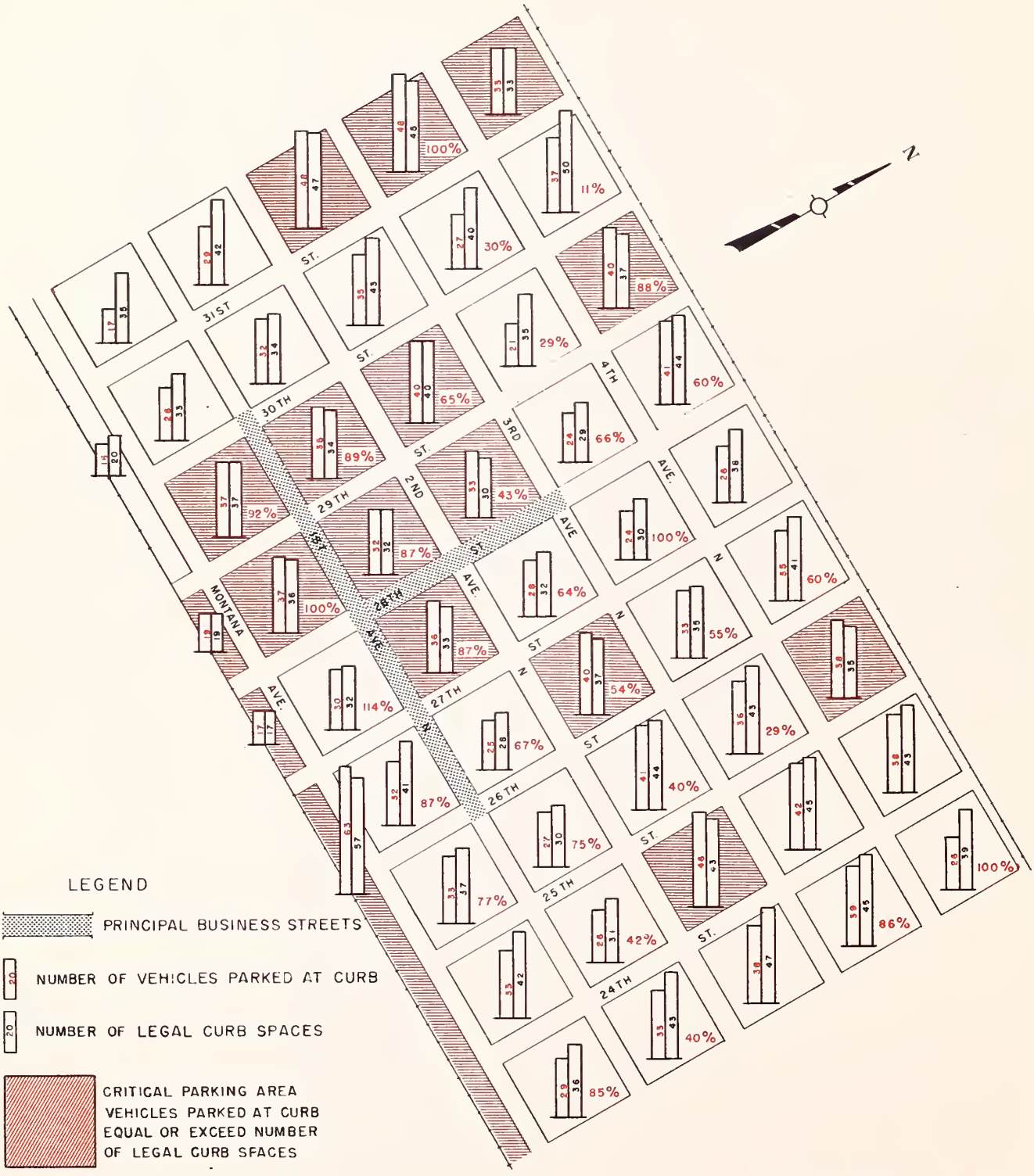


Plate 36

BILLINGS TRAFFIC SURVEY
CURB SPACE & PARKING LOT OCCUPANCY
SATURDAY JULY 24, 1954 - 10:00 TO 11:00 A.M.

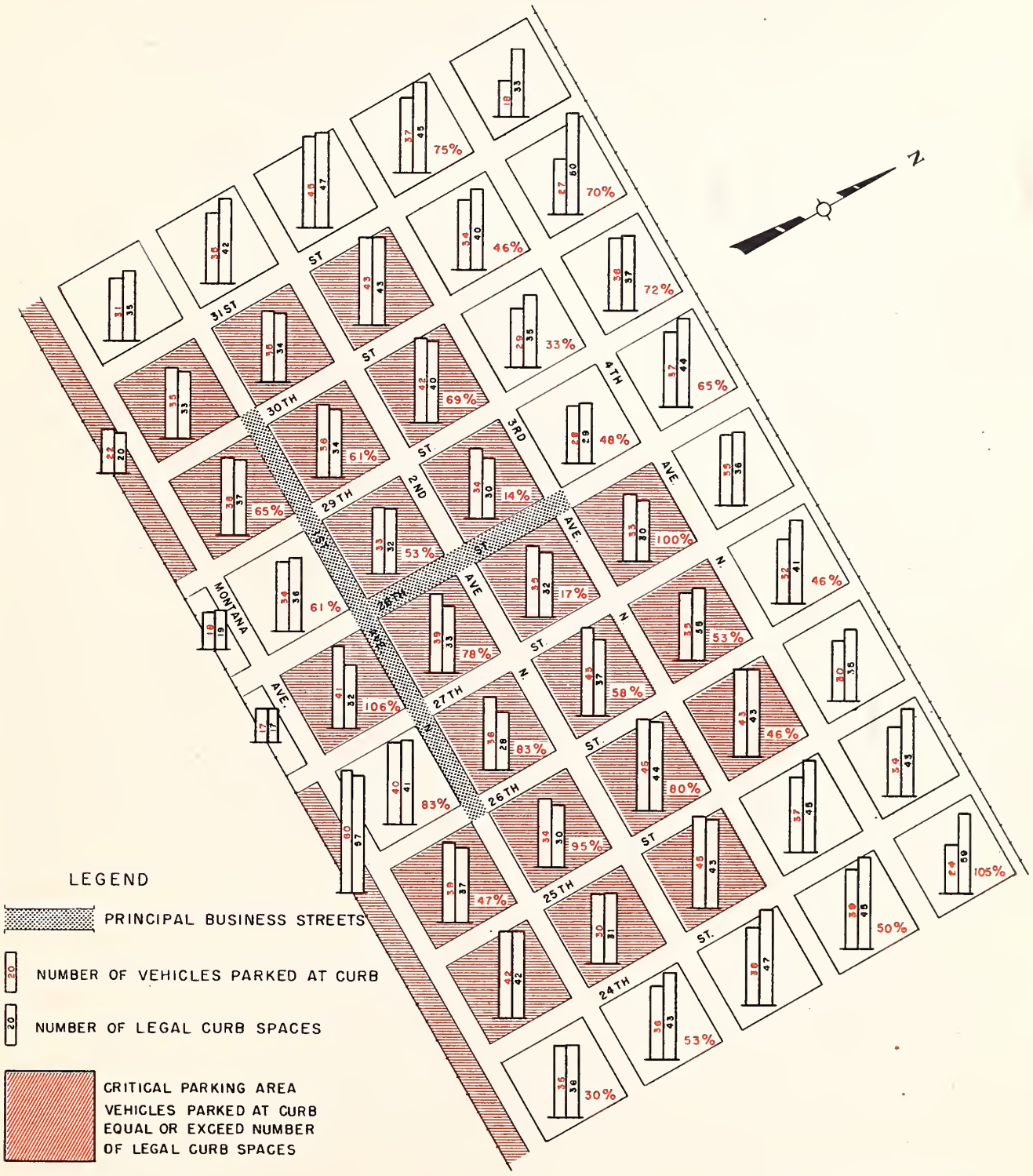


Plate 37

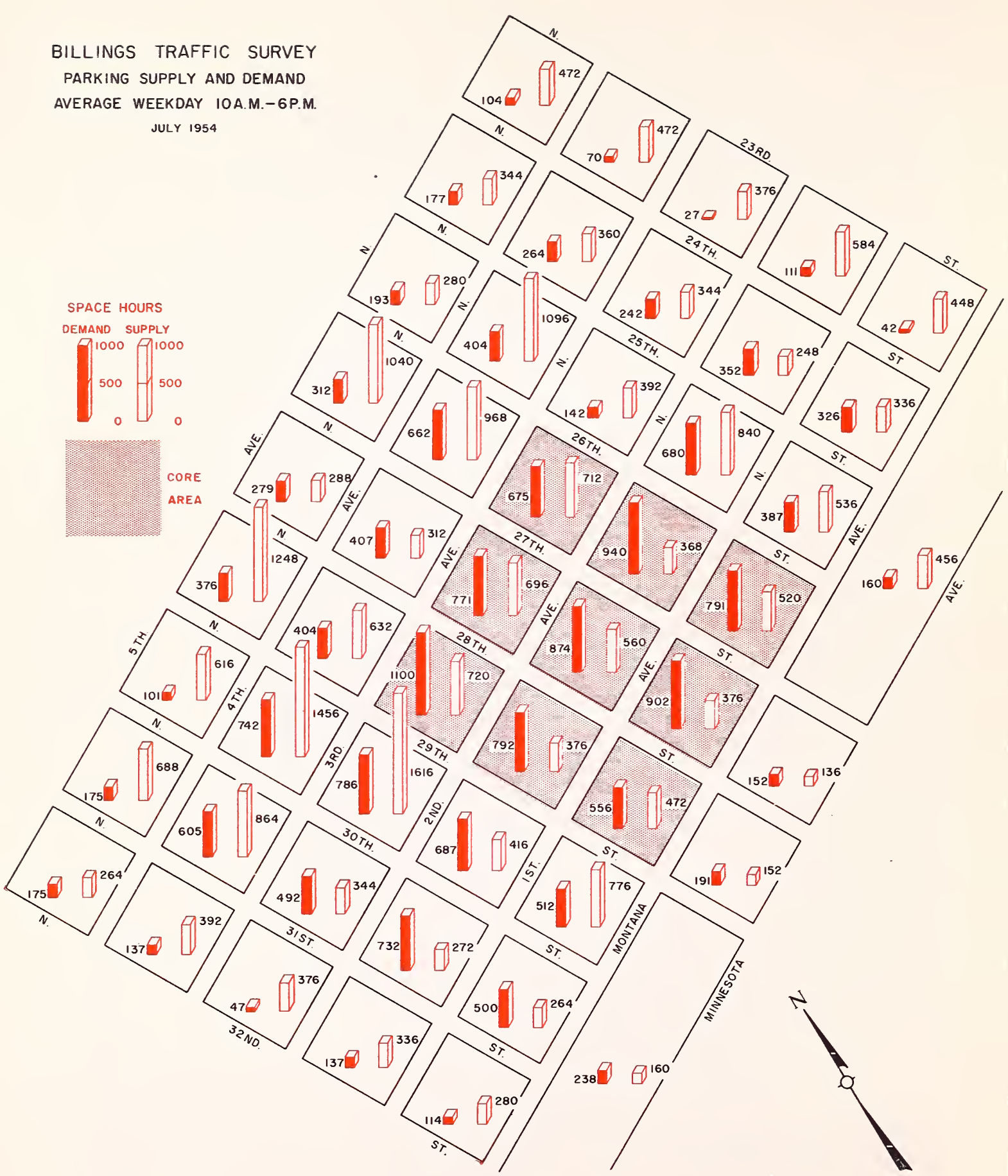
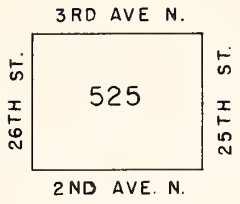

BILLINGS TRAFFIC SURVEY
PARKING SUPPLY AND DEMAND
AVERAGE WEEKDAY 10 A.M.–6 P.M.
JULY 1954
SPACE HOURS
DEMAND SUPPLY
1000
500
0
CORE AREA
N.
AVE.
ST.
23RD
24TH.
25TH.
26TH.
27TH.
28TH.
29TH.
30TH.
31ST.
32ND.
1ST.
2ND.
3RD.
4TH.
5TH
MONTANA
MINNESOTA
104 472
70 472
177 344
27 376
111 584
193 280
264 360
242 344
42 448
404 1096
312 1040
142 392
352 248
326 336
662 968
680 840
279 288
675 712
940 368
387 536
407 312
771 696
791 520
160 456
376 1248
874 560
1100 720
902 376
404 632
792 376
101 616
742 1456
786 1616
556 472
175 688
687 416
605 864
512 776
152 136
175 264
492 344
191 152
137 392
732 272
47 376
500 264
137 336
238 160
114 280
N

Plate 38

BILLINGS TRAFFIC SURVEY
CURB PARKING CHARACTERISTICS
CENTRAL BUSINESS DISTRICT

10 A.M. - 6 P.M.



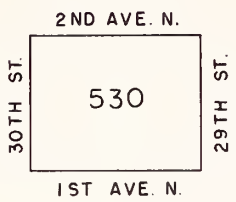
	NORTH FACE 3RD AVE. N.	EAST FACE 25TH ST. N.	SOUTH FACE 2ND AVE. N.	WEST FACE 26TH ST. N.	TOTAL
NUMBER OF 2 HOUR METERS				11	11
NUMBER OF 2 HOUR SPACES			11		11
NUMBER OF UNRESTRICTED SPACES	10	12			22
NUMBER OF VEHICLES PARKED IN LEGAL SPACES (2 HOUR METERS)				60	60
AVERAGE TIME PARKED MINUTES (2 HOUR METERS)				58	58
NUMBER OF VEHICLES PARKED IN LEGAL 2 HOUR SPACES			46		46
AVERAGE TIME PARKED MINUTES (2 HOUR SPACES)			101		101
NUMBER OF VEHICLES PARKED IN LEGAL UNRESTRICTED SPACES	15	28			43
AVERAGE TIME PARKED MINUTES (UNRESTRICTED SPACES)	278	187			219
TOTAL SPACE HOURS AVAILABLE (METERS AND SPACES)	80	96	88	88	352
SPACE HOURS USED (METERS AND SPACES)	69.50	87.25	77.25	58.00	292.00
PER CENT OF AVAILABLE SPACE HOURS USED	86.9	90.9	87.8	65.9	83.0
NUMBER OF VEHICLES PARKED OVER 2 HOURS	12	13	10	6	41
NUMBER OF VEHICLES PARKED *ILLEGALLY	4	1			5
HOURS OF ILLEGAL PARKING	1.75	0.25			2.00
NUMBER OF METER VIOLATIONS				13	13
HOURS OF METER VIOLATIONS				8.00	8.00
PER CENT OF VEHICLES PARKING OVER 1 HOUR	86.7	67.9	58.7	30.0	51.7
PER CENT OF SPACE HOURS USED BY VEHICLES PARKING OVER 1 HOUR	98.9	92.6	87.7	63.4	87.0
PARKING TURNOVER 10 A.M. - 6 P.M. (VEHICLES/SPACE/DAY)	1.5	2.3	4.2	5.5	3.4

*END ZONES, FIRE PLUGS, DOUBLE PARK, ETC.

DURATION OF PARKING	PER CENT OF TOTAL VEHICLES PARKED				
15 MINUTES OR LESS	6.7	3.6	19.6	25.0	17.5
16 MINUTES TO 30 MINUTES	6.7	7.2	8.7	26.7	15.4
31 MINUTES TO 1 HOUR		21.4	13.0	18.3	15.4
61 MINUTES TO 2 HOURS	6.7	21.4	37.0	20.0	24.2
OVER 2 HOURS	79.9	46.4	21.7	10.0	27.5
MAXIMUM TIME PARKED (HOURS)	8.00	8.00	8.00	4.00	8.00

BILLINGS TRAFFIC SURVEY
CURB PARKING CHARACTERISTICS
CENTRAL BUSINESS DISTRICT

10 A.M. - 6 P.M.



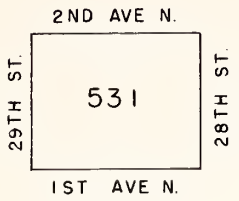
	NORTH FACE 2ND AVE. N.	EAST FACE 29TH ST. N.	SOUTH FACE 1ST AVE. N.	WEST FACE 30TH ST. N.	TOTAL
NUMBER OF 2 HOUR METERS			8	6	14
NUMBER OF 1 HOUR METERS	9				9
NUMBER OF 36 MINUTE METERS		9			9
NUMBER OF 12 MINUTE METERS		1		1	2
NUMBER OF VEHICLES PARKED IN LEGAL SPACES (2 HOUR METERS)			54	41	95
AVERAGE TIME PARKED MINUTES (2 HOUR METERS)			70	67	68
NUMBER OF VEHICLES PARKED IN LEGAL SPACES (1 HOUR METERS)	104				104
AVERAGE TIME PARKED MINUTES (1 HOUR METERS)	39				39
NUMBER OF VEHICLES PARKED IN LEGAL SPACES (36 MINUTE METERS)		123			123
AVERAGE TIME PARKED MINUTES (36 MINUTE METERS)		33			33
NUMBER OF VEHICLES PARKED IN LEGAL SPACES (12 MINUTE METERS)		18		18	36
AVERAGE TIME PARKED MINUTES (12 MINUTE METERS)		23		18	20
TOTAL SPACE HOURS AVAILABLE (ALL METERS)	72	80	64	56	272
SPACE HOURS USED (ALL METERS)	67.25	73.50	62.75	51.00	254.50
PER CENT OF AVAILABLE SPACE HOURS USED	93.4	91.9	98.0	91.1	93.6
NUMBER OF VEHICLES PARKED OVER 1 HOUR	15	9	15	13	52
NUMBER OF VEHICLES PARKED *ILLEGALLY	8	6	3	1	18
HOURS OF ILLEGAL PARKING	2.00	2.00	1.25	0.50	5.75
NUMBER OF METER VIOLATIONS	5	20	14	7	46
HOURS OF METER VIOLATIONS	3.75	10.75	4.50	2.50	21.50
PER CENT OF VEHICLES PARKING OVER 1 HOUR	14.4	6.4	27.8	22.0	14.5
PER CENT OF SPACE HOURS USED BY VEHICLES PARKING OVER 1 HOUR	39.4	22.8	64.1	64.7	45.8
PARKING TURNOVER 10 A.M. - 6 P.M. (VEHICLES/SPACE/DAY)	11.6	14.1	6.8	8.4	10.5

*END ZONES, FIRE PLUGS, DOUBLE PARK, ETC.

DURATION OF PARKING	PER CENT OF TOTAL VEHICLES PARKED				
15 MINUTES OR LESS	41.3	49.7	25.9	49.2	43.6
16 MINUTES TO 30 MINUTES	25.0	25.5	14.8	18.6	22.6
31 MINUTES TO 1 HOUR	19.2	18.4	31.5	10.2	19.3
61 MINUTES TO 2 HOURS	10.6	4.3	18.5	8.5	8.9
OVER 2 HOURS	3.9	2.1	9.3	13.5	5.6
MAXIMUM TIME PARKED (HOURS)	3.00	3.25	8.00	5.00	8.00

BILLINGS TRAFFIC SURVEY
CURB PARKING CHARACTERISTICS
CENTRAL BUSINESS DISTRICT

10 A.M. - 6 P.M.



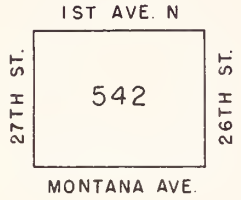
	NORTH FACE 2ND AVE. N.	EAST FACE 28TH ST. N.	SOUTH FACE 1ST AVE. N.	WEST FACE 29TH ST. N.	TOTAL
NUMBER OF 1 HOUR METERS			8		8
NUMBER OF 36 MINUTE METERS	3	9		9	21
NUMBER OF 12 MINUTE METERS		1		1	2
NUMBER OF VEHICLES PARKED IN LEGAL SPACES (1 HOUR METERS)			63		63
AVERAGE TIME PARKED MINUTES (1 HOUR METERS)			58		58
NUMBER OF VEHICLES PARKED IN LEGAL SPACES (36 MINUTE METERS)	35	116		115	266
AVERAGE TIME PARKED MINUTES (36 MINUTE METERS)	39	33		34	34
NUMBER OF VEHICLES PARKED IN LEGAL SPACES (12 MINUTE METERS)		21		16	37
AVERAGE TIME PARKED MINUTES (12 MINUTE METERS)		21		22	21
TOTAL SPACE HOURS AVAILABLE (ALL METERS)	24	80	64	80	248
SPACE HOURS USED (ALL METERS)	22.75	71.50	61.00	72.00	227.25
PER CENT OF AVAILABLE SPACE HOURS USED	94.8	89.4	95.3	90.0	91.6
NUMBER OF VEHICLES PARKED OVER 1 HOUR	4	9	19	11	43
NUMBER OF VEHICLES PARKED *ILLEGALLY	15	4	11	16	46
HOURS OF ILLEGAL PARKING	3.75	1.50	3.00	4.00	12.25
NUMBER OF METER VIOLATIONS	3	18	6	26	53
HOURS OF METER VIOLATIONS	1.50	6.75	7.00	9.00	24.25
PER CENT OF VEHICLES PARKING OVER 1 HOUR	11.4	6.6	30.2	8.4	11.7
PER CENT OF SPACE HOURS USED BY VEHICLES PARKING OVER 1 HOUR	45.1	17.8	62.7	24.7	34.8
PARKING TURNOVER 10 A.M. - 6 P.M. (VEHICLES/SPACE/DAY)	11.7	13.7	7.9	13.1	11.8

*END ZONES, FIRE PLUGS, DOUBLE PARK, ETC.

DURATION OF PARKING	PER CENT OF TOTAL VEHICLES PARKED				
15 MINUTES OR LESS	48.6	48.9	28.6	48.9	45.4
16 MINUTES TO 30 MINUTES	28.6	19.0	19.0	19.1	19.9
31 MINUTES TO 1 HOUR	11.4	25.5	22.2	23.7	22.9
61 MINUTES TO 2 HOURS	8.6	6.6	20.7	7.6	9.6
OVER 2 HOURS	2.8		9.5	0.7	2.2
MAXIMUM TIME PARKED (HOURS)	5.75	2.00	4.75	4.00	5.75

BILLINGS TRAFFIC SURVEY
CURB PARKING CHARACTERISTICS
CENTRAL BUSINESS DISTRICT

10 A.M. - 6 P.M.

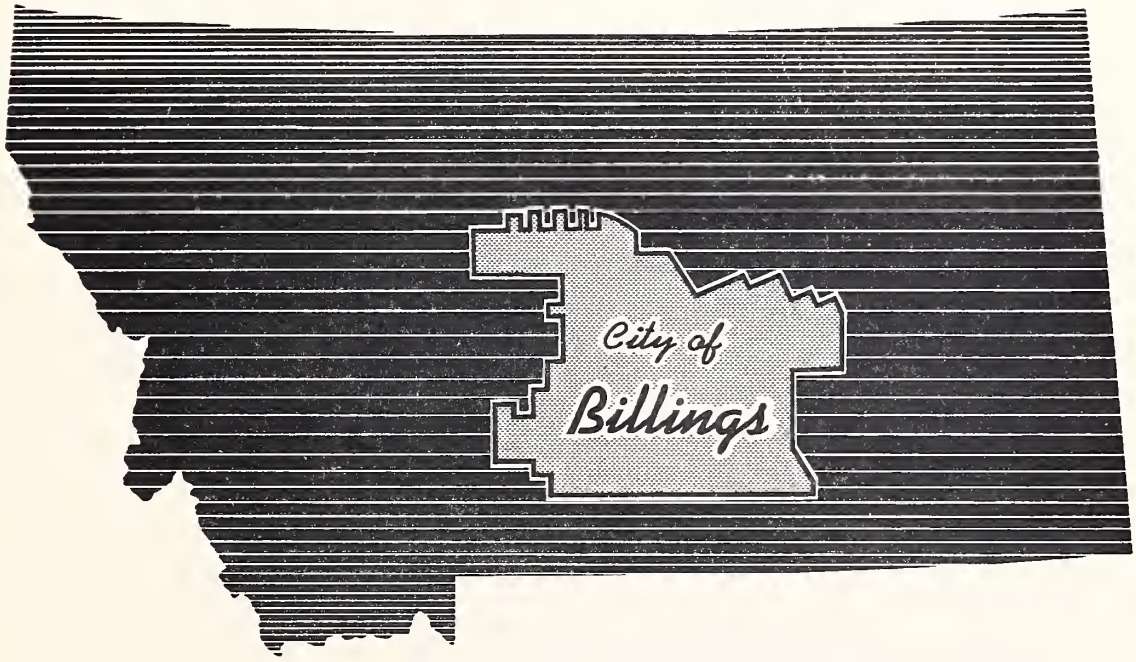


	NORTH FACE 1ST AVE. N.	EAST FACE 26TH ST. N.	SOUTH FACE MONT. AVE.	WEST FACE 27TH ST. N.	TOTAL
NUMBER OF 2 HOUR METERS		4	10		14
NUMBER OF 1 HOUR METERS				7	7
NUMBER OF 12 MINUTE METERS	6	5		3	14
NUMBER OF 10 MINUTE FREE SPACES	5				5
NUMBER OF VEHICLES PARKED IN LEGAL SPACES (2 HOUR METERS)		37	72		109
AVERAGE TIME PARKED MINUTES (2 HOUR METERS)		49	64		59
NUMBER OF VEHICLES PARKED IN LEGAL SPACES (1 HOUR METERS)				58	58
AVERAGE TIME PARKED MINUTES (1 HOUR METERS)				57	57
NUMBER OF VEHICLES PARKED IN LEGAL SPACES (12 MINUTE METERS)	105	83		44	232
AVERAGE TIME PARKED MINUTES (12 MINUTE METERS)	21	20		27	22
NUMBER OF VEHICLES PARKED IN LEGAL SPACES (10 MINUTE SPACES)	107				107
AVERAGE TIME PARKED MINUTES (10 MINUTE SPACES)	16				16
TOTAL SPACE HOURS AVAILABLE (ALL METERS)	88	72	80	80	320
SPACE HOURS USED (ALL METERS)	65.25	57.75	77.25	74.75	275.00
PER CENT OF AVAILABLE SPACE HOURS USED	74.1	80.2	96.6	93.4	85.9
NUMBER OF VEHICLES PARKED OVER 1 HOUR	3	9	27	18	57
NUMBER OF VEHICLES PARKED *ILLEGALLY	9		1	3	13
HOURS OF ILLEGAL PARKING	2.25		0.75	0.75	3.75
NUMBER OF METER VIOLATIONS	21	19	5	31	76
HOURS OF METER VIOLATIONS	8.25	7.00	5.25	18.75	39.25
PER CENT OF VEHICLES PARKING OVER 1 HOUR	1.4	7.5	37.5	17.6	11.3
PER CENT OF SPACE HOURS USED BY VEHICLES PARKING OVER 1 HOUR	6.5	31.2	71.2	49.8	41.6
PARKING TURNOVER 10 A.M. - 6 P.M. (VEHICLES/SPACE/DAY)	19.3	13.3	7.2	10.2	12.7

*END ZONES, FIRE PLUGS, DOUBLE PARK, ETC.

DURATION OF PARKING	PER CENT OF TOTAL VEHICLES PARKED				
15 MINUTES OR LESS	86.3	65.8	25.0	50.0	65.4
16 MINUTES TO 30 MINUTES	8.5	15.0	19.4	10.8	12.1
31 MINUTES TO 1 HOUR	3.8	11.7	18.1	21.5	11.3
61 MINUTES TO 2 HOURS	1.4	5.0	29.2	11.8	8.3
OVER 2 HOURS		2.5	8.3	5.9	2.9
MAXIMUM TIME PARKED (HOURS)	1.75	3.00	7.75	3.75	7.75

Part Five



Urban Route Analyses

URBAN ROUTE ANALYSES

The two urban routes selected in Billings for analytical treatment are extensions of the State Highway System through the City. In relation to most other local streets the traffic on these arterials is heavier in both gross weight and volume.

The following analyses consist basically of computing the intersection traffic capacities along each route by the use of approved methods detailed in the Highway Capacity Manual published by Bureau of Public Roads. Intersection capacity is calculated by taking into consideration such items as the volume and characteristics of the traffic flow, geometric design of the intersection, operation of the traffic control devices, extent of curb parking, and type of bus loading operations. All of these items affect the traffic carrying capacity of an urban intersection in varying degrees.

In addition to the traffic capacity calculations along each route, the number of accidents was obtained from the Billings Police Department's files for the period of July 1, 1953 to June 30, 1954. Speed and delay studies and spot speed checks were also made to obtain overall speeds during both peak and off-peak hours.

It is necessary that all of these studies be interpreted with the use of some judgement in order to arrive at the relative efficiency of each route. One rule of thumb, however, has been developed by the Washington State Highway Traffic Division which is: serious Urban Highway inadequacy can be considered to exist where there simultaneously occurs a high accident rate, a low overall speed, and a calculated deficiency in traffic capacity.

U.. S.. 10

Plates 43 and 44 illustrate existing conditions on U.S. 10 from Fifth Street West to 25th Street. It will be noted that average speeds drop to

approximately five miles per hour on the section of Division Street from First Avenue North to Montana Avenue. This condition can be corrected to to some extent by adjusting the signal timing as shown on Plate 54. A spot speed station operated between First and Second Streets West indicates an 85 percentile speed of 33 miles per hour compared to a posted speed of 25 miles per hour. This condition has been called to the City's attention and the speed limit has now been raised to 35 miles per hour.

The five block section from 30th to 25th Streets has a calculated accident rate of 75.3 per million vehicle miles. This calcuated rate does not mean much unless it is compared to some norm. Unfortunately Montana does not have adequate data to compute urban accident rates on a state-wide basis. This rate can, however, be compared to Oregon's state-wide average of 23.5 on all urban extensions of state highways in cities of over 10,000 population.

The comparatively high accident rate and low overall speeds on this section bear out the capacity calculations which indicate that three of the six intersections were operating at about practical traffic capacity during peak hours. This condition leaves very little room for an estimated 60 percent traffic increase during the next 20 years.

27TH STREET NORTH

Twenty-seventh Street is an urban extension of F.A.S. Route 301. This route is carrying primary traffic composed of about 15 per cent commercial vehicles. The comparatively heavy concentration of commercial vehicles tends to reduce the overall capacity and creates considerable congestion during peak hours. The construction of the proposed truck route between F.A.S. 301 and U.S. 10 will divert the heavy truck traffic from the downtown area and should relieve 27th Street of much of the present congestion due to heavy commercial units.

The intersections of First, Second, and Sixth Avenues North were operating at over practical traffic capacity during peak hours in August of 1954. Inasmuch as the traffic carrying capacity of the entire route is affected by the least efficient intersection, it is imperative that something be done in the near future to provide additional capacity. This can be achieved by street widening, prohibiting curb parking on one or both sides during rush hours or changing to one-way operation.

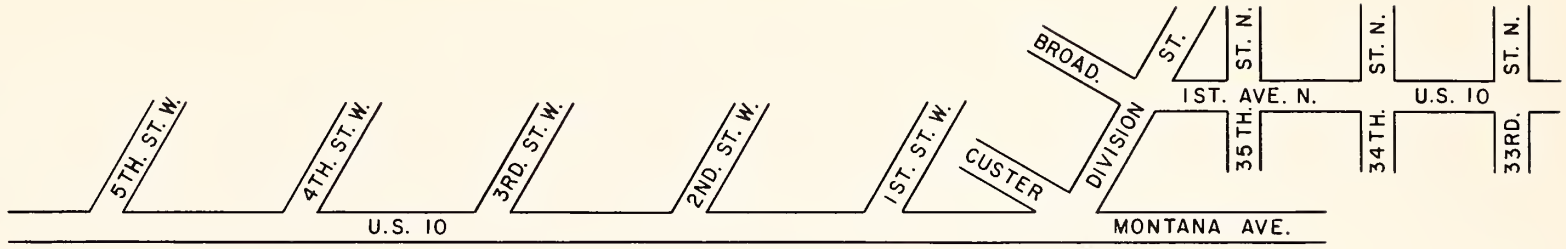
Of these alternates it is believed that one way street operation will provide the most relief from congestion for the least expenditure. The recommended North - South one way couplet on 28th and 29th Streets should divert a sufficient amount of traffic from 27th Street to enable this arterial to operate satisfactorily for the next 10 - 15 years. Similarly, traffic diversion from U.S. 10 on First Avenue North to the proposed East - West couplet on Second and Third Avenues North should provide adequate relief from the present congestion, and should enable First Avenue North to operate satisfactorily in the foreseeable future.

Plate 47 shows the location of all street intersections in Billings that had five or more accidents during the period from July 1, 1953 to June 30, 1954, and the location of those intersections that were operating above practical traffic capacity. It will be noted that most intersections having a large number of accidents were found to be operating at or above practical traffic capacity.

BILLINGS TRAFFIC SURVEY

URBAN ROUTE ANALYSES

U.S. 10 — FROM 5TH. ST. W. TO 25TH. ST.



AVERAGE SPEED
---- EASTBOUND
———— WESTBOUND

INTERSECTIONS	5TH. ST. W.	4TH. ST. W.	3RD. ST. W.	2ND. ST. W.	1ST. ST. W.	MONTANA AVE.	DIVISION ST.	35TH. ST. N.	34TH. ST. N.	33RD. ST. N.
AREA CLASSIFICATION	OUTLYING									
PAVEMENT WIDTH & TYPE	60' BITUMINOUS CONCRETE					56' BITUMINOUS CONCRETE				
PARKING CONTROLS	PARALLEL PARKING NORTH SIDE ONLY					PARALLEL PARKING BOTH SIDES				
TRAFFIC CONTROLS	SIGNAL					SIGNALS				
ACCIDENTS — RATE PER MILLION V.M.	9.1					38.2				
ACCIDENTS — NUMBER AND TYPE	3 INJURIES 7 PROP. DAM.	1 INJURY	2 PROP. DAM.	2 PROP. DAM.	3 PROP. DAM.	2 INJ. 6 P.D.	6 P.D.	2 P.D.	2 P.D.	
SPEED ZONES — EXISTING	25 M.P.H.							25 M.P.H.		
SPEED ZONES — PROPOSED	35 M.P.H.							25 M.P.H.		

OFF PEAK HOUR AVERAGE OVERALL SPEED (M.P.H.: 20, 10, 0)
SPOT SPEED STATION
AVERAGE SPEED 27.9
85 % SPEED 33.0

CRITICAL APPROACH CAPACITY ——— (VEHICLES PER HOUR: 1500, 1000, 600, 500, 400, 300, 200) *

1954 TRAFFIC DESIGN HOUR VOLUMES ———

EVALUATION: ADEQUATE UNTIL 1974

* NOTE DIFFERENCE IN SCALE

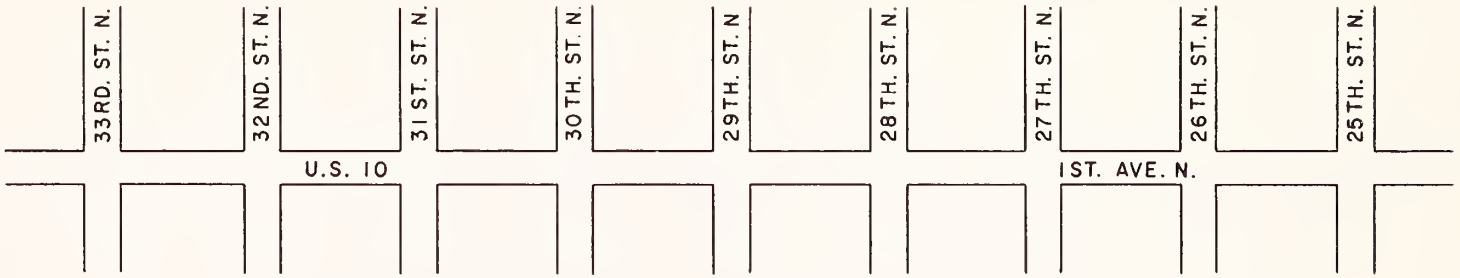
Plate 43

BILLINGS TRAFFIC SURVEY

URBAN ROUTE ANALYSES

U.S. 10 — FROM 5TH. ST. W. TO 25 TH. ST.

AVERAGE SPEED
---- EASTBOUND
———— WESTBOUND



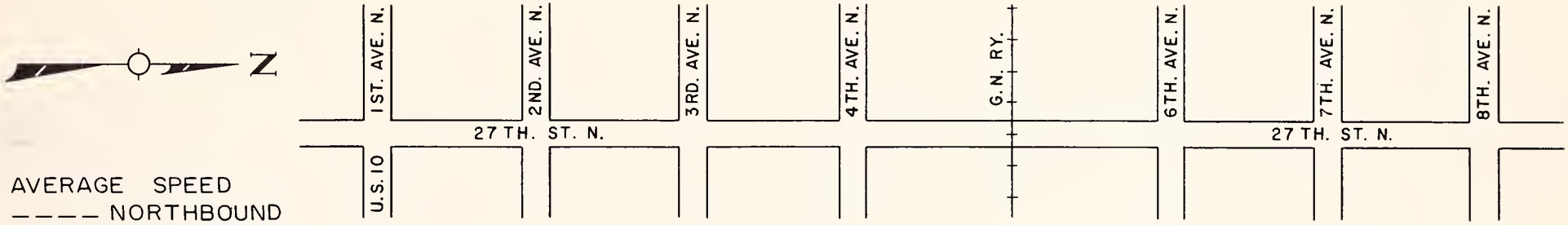
INTERSECTIONS		33RD. ST. N. · 32ND. ST. N. · 31ST. ST. N. · 30 TH. ST. N. · 29 TH. ST. N. · 28 TH. ST. N. · 27TH. ST. N. · 26 TH. ST. N. · 25TH. ST. N.
AREA CLASSIFICATION		OUTLYING · INTERMEDIATE · DOWNTOWN · INTERMEDIATE
PAVEMENT WIDTH & TYPE		56' BITUMINOUS CONCRETE
PARKING CONTROLS		PARALLEL METERED CURB BOTH SIDES
TRAFFIC CONTROLS		SIGNAL · SIGNAL · SIGNAL · SIGNAL · SIGNAL · SIGNAL · SIGNAL
ACCIDENTS	RATE PER MILLION V. M.	38.2 · 75.3
	NUMBER AND TYPE	1 INJURY 16 PROP. DAM · 1 INJURY 13 PROP. DAM · 9 PROP. DAM · 2 INJURIES 20 PROP. DAM · 13 PROP. DAM · 1 INJURY 21 PROP. DAM · 3 INJURIES 27 PROP. DAM · 2 INJURIES 10 PROP. DAM
SPEED ZONES	EXISTING	25 M.P.H.
	PROPOSED	25 M.P.H.
OFF PEAK HOUR AVERAGE OVERALL SPEED	M.P.H. 20 / 10 / 0	STOP SPEED STATION · AVERAGE SPEED 22.2 · 85 % SPEED 26.0
CRITICAL APPROACH CAPACITY ——	VEHICLES PER HOUR 600 / 500 / 400 / 300 / 200 / 100	
1954 TRAFFIC DESIGN HOUR VOLUMES ——		
EVALUATION		ADEQUATE UNTIL 1974 · CRITICAL SECTION · ADEQUATE 1974

Plate 77

BILLINGS TRAFFIC SURVEY

URBAN ROUTE ANALYSES

27TH. ST. — FROM 1ST. AVE. N. TO POLY DRIVE



AVERAGE SPEED
---- NORTHBOUND
———— SOUTHBOUND

INTERSECTIONS	1ST. AVE. N.	2ND. AVE. N.	3RD. AVE. N.	4TH. AVE. N.	G.N. RY.	6TH. AVE. N.	7TH. AVE. N.	8TH. AVE. N.
AREA CLASSIFICATION	DOWNTOWN			INTERMEDIATE			OUTLYING	
PAVEMENT WIDTH & TYPE	50' BITUMINOUS							
PARKING CONTROLS	PARALLEL METERED CURB BOTH SIDES					PARALLEL CURB BOTH SIDES		
TRAFFIC CONTROLS	SIGNAL	SIGNAL	SIGNAL	SIGNAL		SIGNAL		
ACCIDENTS — RATE PER MILLION V.M.	38.9						16.9	
ACCIDENTS — NUMBER AND TYPE	6 PROP. DAM.	1 INJURY 14 PROP. DAM.	1 INJURY 9 PROP. DAM.	5 PROP. DAM.	9 PROP. DAM.	11 PROP. DAM.	2 PROP. DAM.	
SPEED ZONES — EXISTING	NOT POSTED						25 M.P.H.	
SPEED ZONES — PROPOSED	25 M.P.H.							

OFF PEAK HOUR AVERAGE OVERALL SPEED (M.P.H.: 20, 10, 0)

SPOT SPEED STATION — AVERAGE SPEED 22.3 — 85 % SPEED 26.0

CRITICAL APPROACH CAPACITY ——
1954 TRAFFIC DESIGN HOUR VOLUMES ——
(VEHICLES PER HOUR: 600, 500, 400, 300, 200, 100)

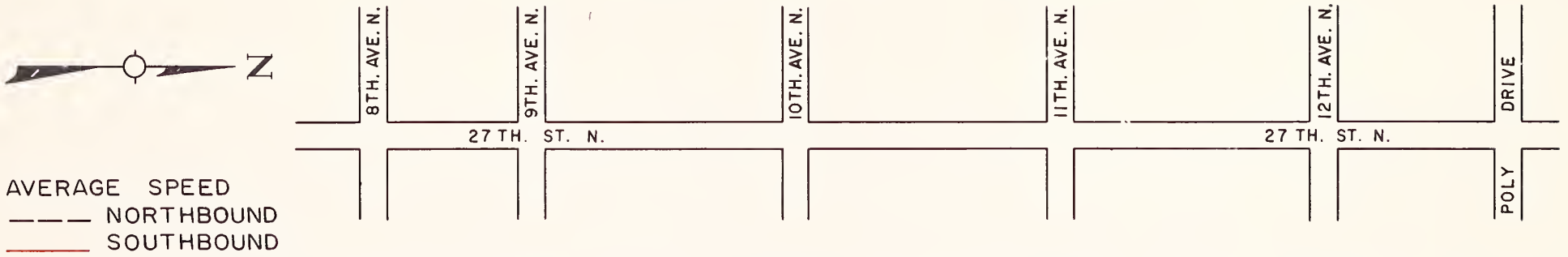
EVALUATION	CRITICAL SECTION	ADEQUATE 1960-1964

Plate 45

BILLINGS TRAFFIC SURVEY

URBAN ROUTE ANALYSES

27TH. ST. — FROM 1ST. AVE. N. TO POLY DRIVE



AVERAGE SPEED
---- NORTHBOUND
———— SOUTHBOUND

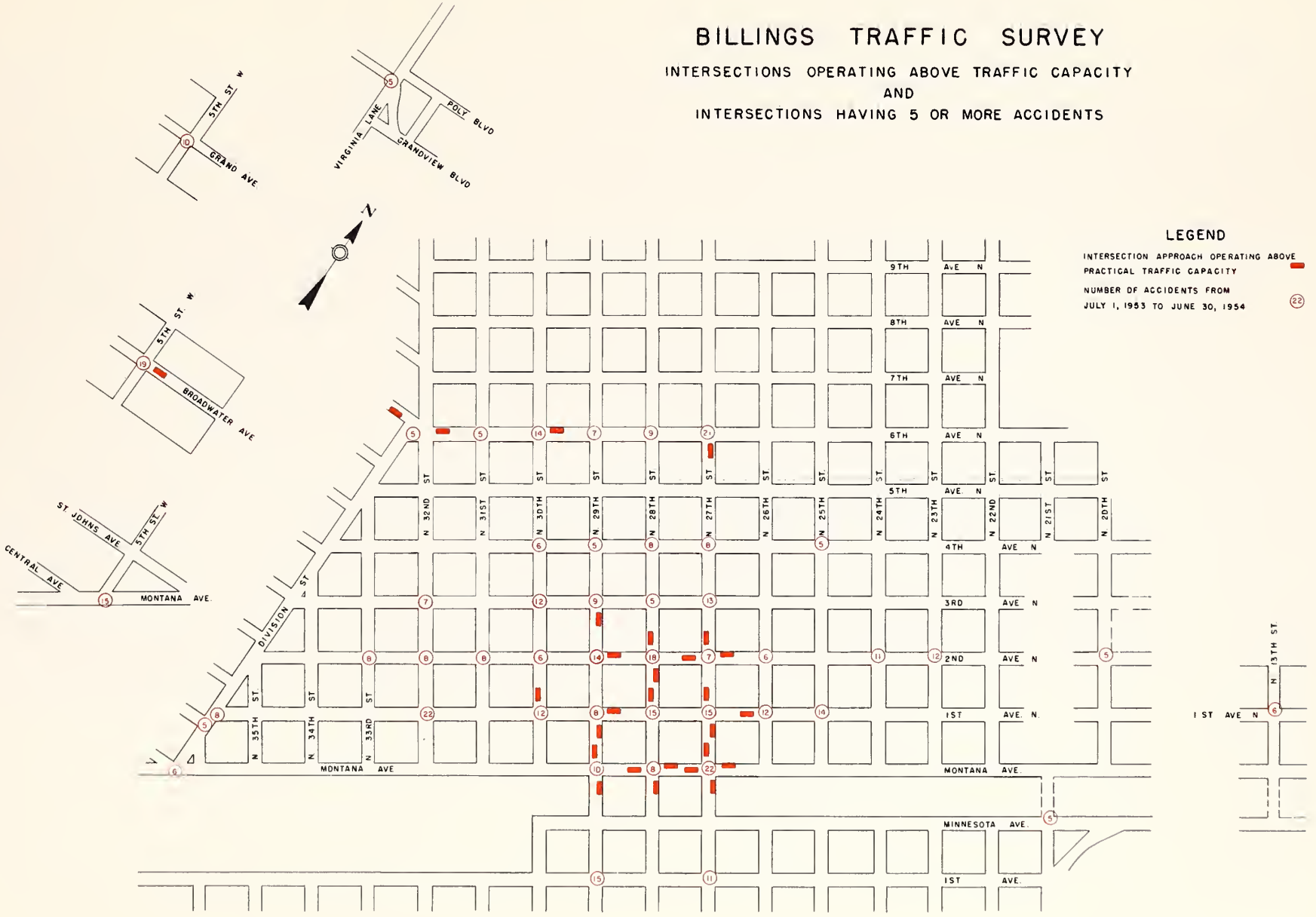
INTERSECTIONS		8 TH. AVE. N.	9 TH. AVE. N.	10TH. AVE. N.	11 TH. AVE. N.	12TH. AVE. N.	POLY DRIVE
AREA CLASSIFICATION		OUTLYING					
PAVEMENT WIDTH & TYPE		50' BITUMINOUS					
PARKING CONTROLS		PARALLEL CURB BOTH SIDES					
TRAFFIC CONTROLS			PEDESTRIAN CROSSING				
ACCIDENTS	RATE PER MILLION V.M.	16.9					
	NUMBER AND TYPE	1 INJURY 4 PROP. DAM.	3 PROP. DAM.	1 INJURY 2 PROP. DAM.	1 PROP. DAM.	1 INJURY 7 PROP. DAM.	
SPEED ZONES	EXISTING	25 M.P.H.	15 M.P.H.	25 M.P.H.			
	PROPOSED	25 M.P.H.	15 M.P.H.	25 M.P.H.			
OFF PEAK HOUR AVERAGE OVERALL SPEED	M.P.H. 20						
	10						
	0						
CRITICAL APPROACH CAPACITY ——	VEHICLES PER HOUR 600						
	500						
	400						
1954 TRAFFIC DESIGN HOUR VOLUMES ——	300						
	200						
	100						
EVALUATION		ADEQUATE UNTIL 1960—1964					

Plate 46

Plate 17

BILLINGS TRAFFIC SURVEY

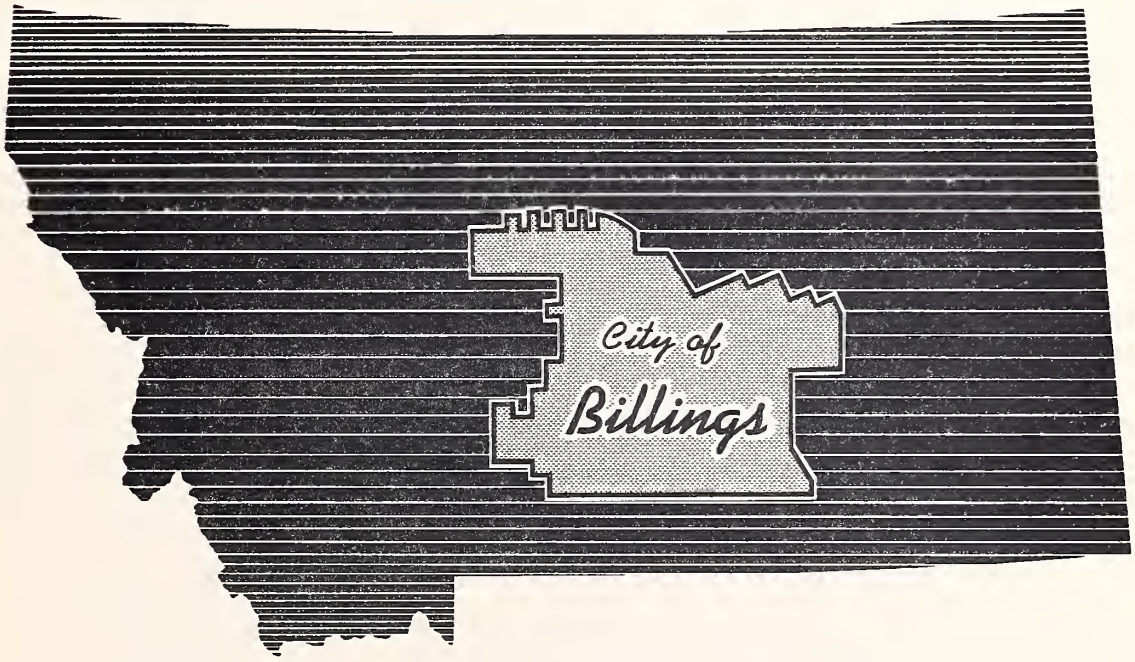
INTERSECTIONS OPERATING ABOVE TRAFFIC CAPACITY
AND
INTERSECTIONS HAVING 5 OR MORE ACCIDENTS



Stockyard and Industrial District

Carp's Photo

Part Six



Speed & Delay Studies

SPEED AND DELAY STUDIES

During August of 1954 speed and delay studies were made on 1st Avenue North and 27th Street North to determine the amount, location, frequency, and cause of traffic delays encountered during both the peak and off peak hours. Peak hour observations were made between 4:30 and 5:30 P.M. and off peak between the hours of 10:00 and 11:00 A.M.

The field work was accomplished by using an automobile to *float* with the traffic for at least five runs in each direction on both of the selected routes. All delays that reduced speeds to under five miles per hour were timed, classified, and recorded. The elapsed time in seconds between each intersection was also recorded so that average speeds could be computed.

The following charts analyse and portray these data. Included are such items as the actual time spent in traveling in each direction, amount, and type of delays encountered, and average speeds during both peak and off peak hours. The charts illustrating the peak hour of traffic readily show the amount of congestion on each route as measured by average speeds and number and length of delays. A further breakdown of the characteristics of the delays during the peak hour is also shown so that some clues to remedial measures might become evident.

1ST AVENUE NORTH

Plates 48, 49, and 50 present various analyses of typical driving conditions on 1st Avenue North (U.S. 10 and 12) during both the peak and off peak hours of traffic in July 1954. It will be noted that average running speeds during peak hour over this route were 15.5 miles per hour west bound and 17.4 miles per hour east bound. Minimum overall speeds and maximum delays were recorded between 35th and Division Streets west bound and Montana

and Broadwater Avenues east bound. Average overall speeds west bound between 35th and Division were computed at 4.9 miles per hour including an average delay of 27 seconds. East bound speeds between Montana and Broadwater Avenues were 6.6 miles per hour with an average delay of 16 seconds.

The signals at Montana, Broadwater, and Division Streets are necessarily operating on a three phase 70 second cycle, which is the cause of a portion of the excessive delays. It is believed however that the recommended adjustment in the timing of these three signals shown on Plate 54 will result in the elimination of at least part of the present delay now caused by traffic signals.

Overall speeds in the downtown area between 32nd and 25th Streets ranged from 8.1 miles per hour in the block between 27th and 28th Streets upward to 21.6 miles per hour between 32nd and 31st. Delays at intersections accounted for approximately 98 per cent of the total standing delay on the route. Part of this delay can be attributed to general congestion found during peak hours on the *downtown* section which should be reduced when 2nd and 3rd Avenues are operated as one-way streets. The orderly progression of the remaining traffic should be improved by adjusting the signal timing as shown on Plate 54.

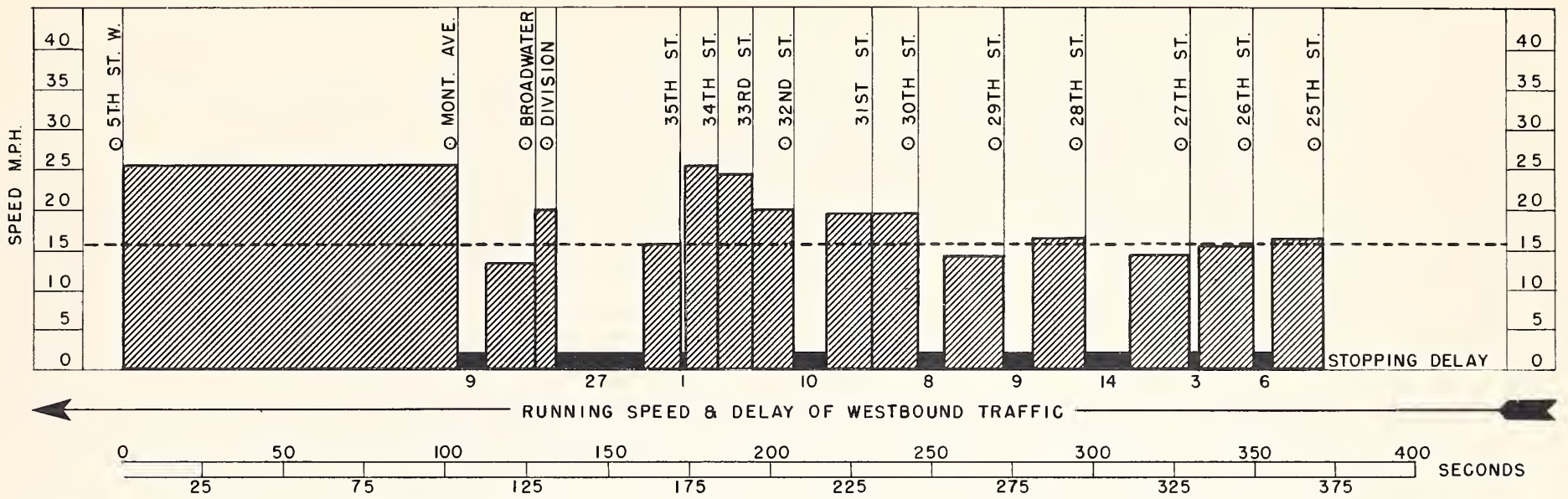
27TH STREET NORTH

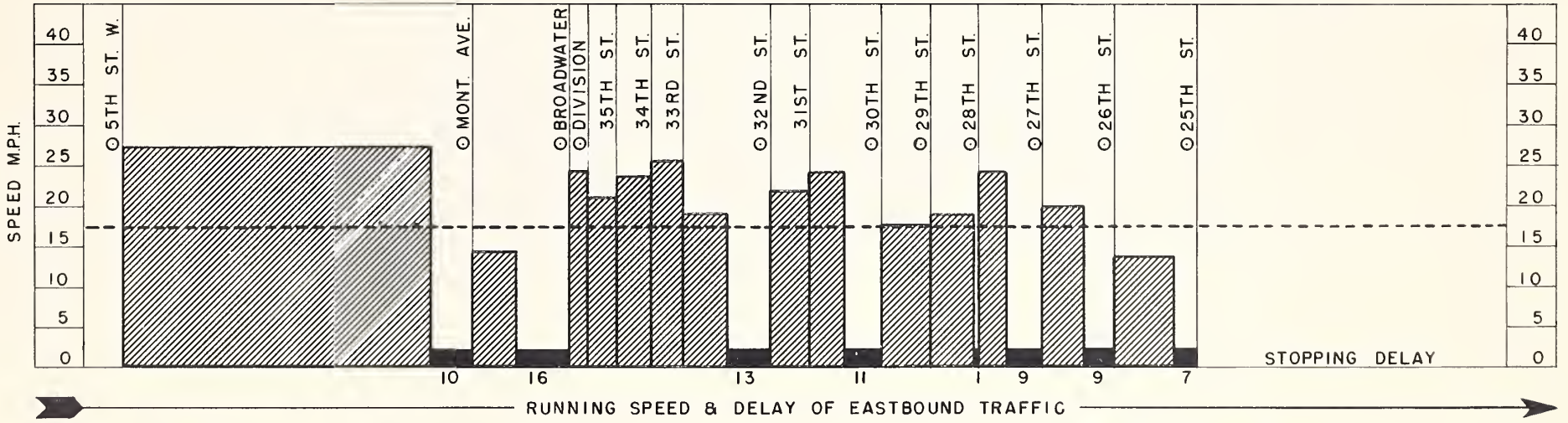
Plates 51, 52, and 53 illustrate the results of the speed and delay studies on 27th Street North from First Avenue North to Poly Drive. Average overall speeds on the entire section during the peak hour were 13.4 miles per hour south bound and 14.3 miles per hour north bound, with a minimum of 5.2 miles per hour between 2nd and 3rd Avenues North. Relatively low overall speeds south bound between 1st and 3rd Avenues North, and north bound between 3rd and 6th Avenues can be attributed to a large extent to the fact that the intersections of 27th Street and 1st, 2nd, and 6th Avenues North were operating above practical traffic capacity. This condition should be

relieved by the operation of 28th and 29th Streets as a one-way couplet and the construction of the proposed truck by-pass between F.A.S. 301 and U.S. 10 and 12. Traffic progression should also be improved by adjusting the signal timing as shown on Plate 55.

BILLINGS TRAFFIC SURVEY
PEAK HOUR SPEED & DELAY
U.S. 10 FROM 25TH ST. TO 5TH ST. WEST

1.60 MILES





LEGEND

- AVERAGE RUNNING SPEED
- AVERAGE OVERALL SPEED
- AVERAGE STOPPING DELAY
- 2 NUMBER OF SECONDS
- ⊙ SIGNAL LOCATIONS

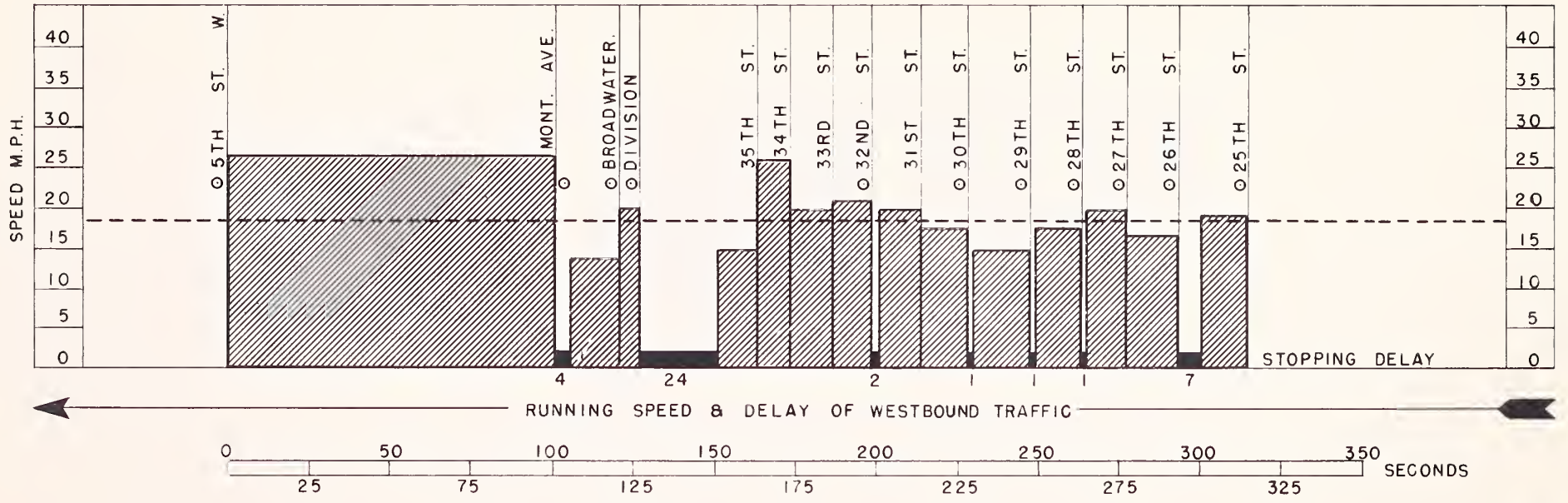
SUMMARY OF PEAK HOUR

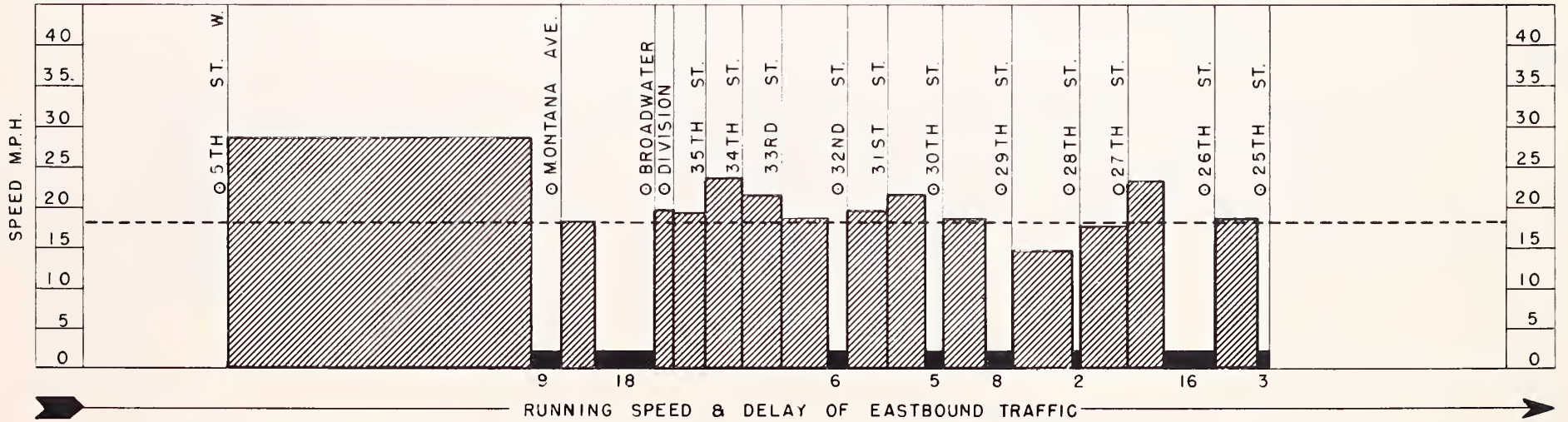
	WESTBOUND	EASTBOUND
TOTAL RUNNING TIME	6 MIN. 12 SEC.	5 MIN. 32 SEC.
TOTAL STOPPING DELAY	1 MIN. 27 SEC.	1 MIN. 16 SEC.
AVERAGE OVERALL SPEED	15.5 M.P.H.	17.4 M.P.H.

Plate 48

BILLINGS TRAFFIC SURVEY
OFF PEAK HOUR SPEED & DELAY
U.S. 10 FROM 25TH ST. TO 5TH ST. WEST

1 60 MILES





LEGEND

- AVERAGE RUNNING SPEED
- AVERAGE OVERALL SPEED
- AVERAGE STOPPING DELAY
- 2 NUMBER OF SECONDS
- ⊙ SIGNAL LOCATIONS

SUMMARY OF OFF PEAK HOUR

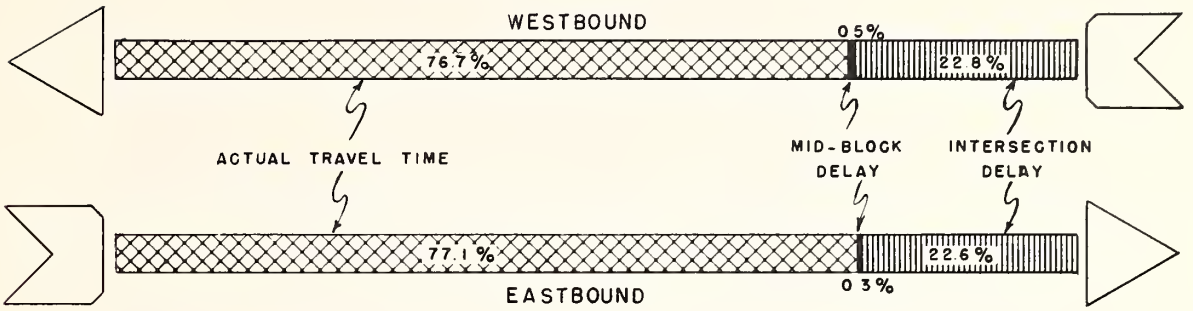
	WESTBOUND	EASTBOUND
TOTAL RUNNING TIME	5 MIN. 15 SEC.	5 MIN. 22 SEC.
TOTAL STOPPING DELAY	40 SEC.	1 MIN. 7 SEC.
AVERAGE OVERALL SPEED	18.3 M.P.H.	17.9 M.P.H.

Plate 49

BILLINGS TRAFFIC SURVEY
PEAK HOUR - DELAY ANALYSIS
U.S. 10 FROM 25TH ST. TO 5TH ST. WEST

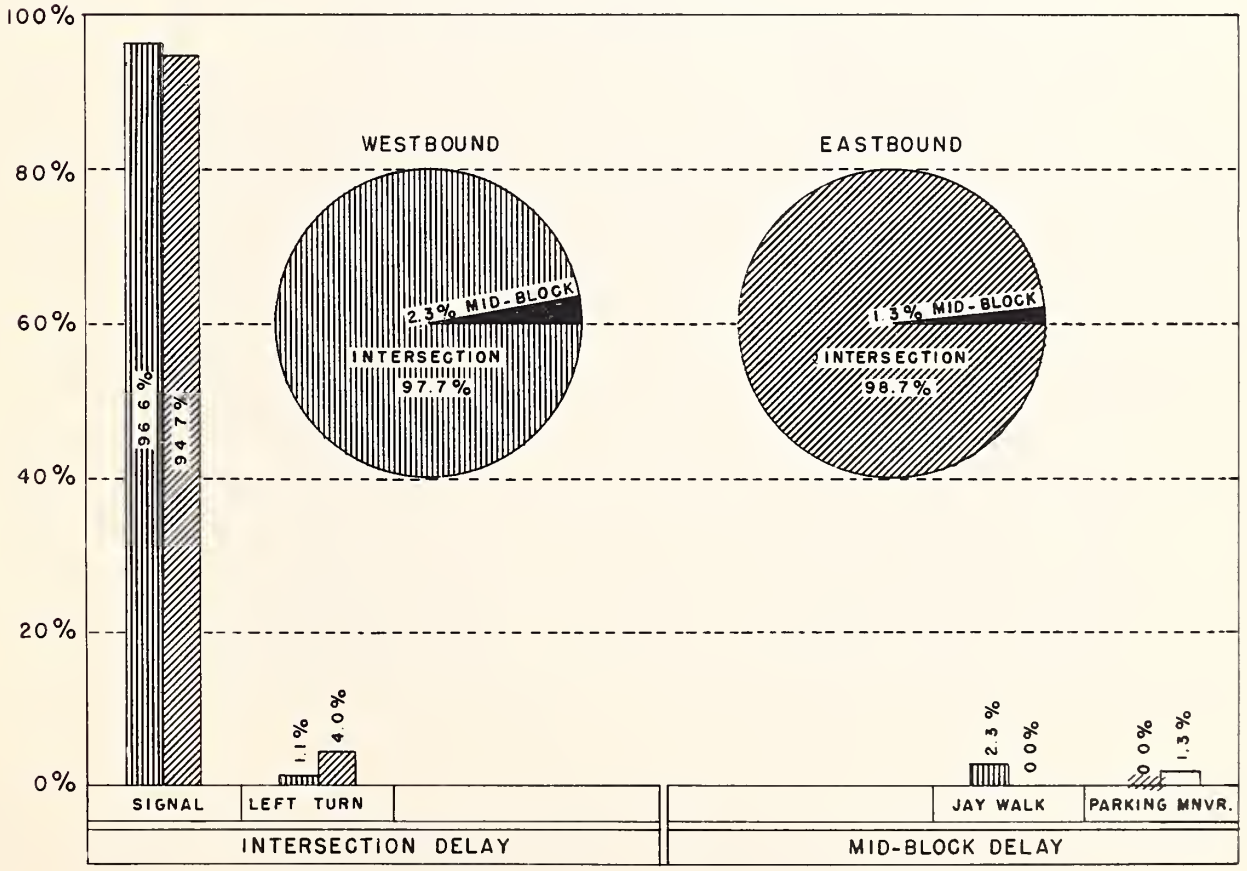
1.60 MILES

PER CENT OF OVERALL TIME



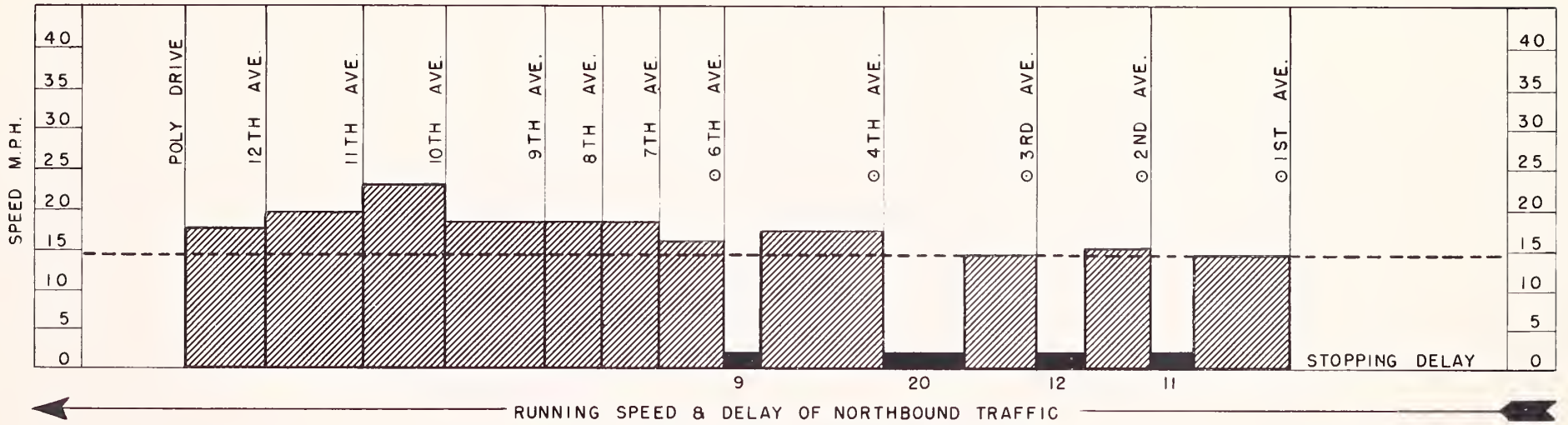
	PEAK HOUR		OFF PEAK HOUR	
	WESTBOUND	EASTBOUND	WESTBOUND	EASTBOUND
AVERAGE OVERALL TIME	6 MIN. 12 SEC.	5 MIN. 32 SEC.	5 MIN. 15 SEC.	5 MIN. 22 SEC.
AVERAGE OVERALL SPEED	15.5 M.P.H.	17.4 M.P.H.	18.3 M.P.H.	17.9 M.P.H.
AVERAGE TRAVELING SPEED	20.2 M.P.H.	22.5 M.P.H.	21.0 M.P.H.	22.6 M.P.H.

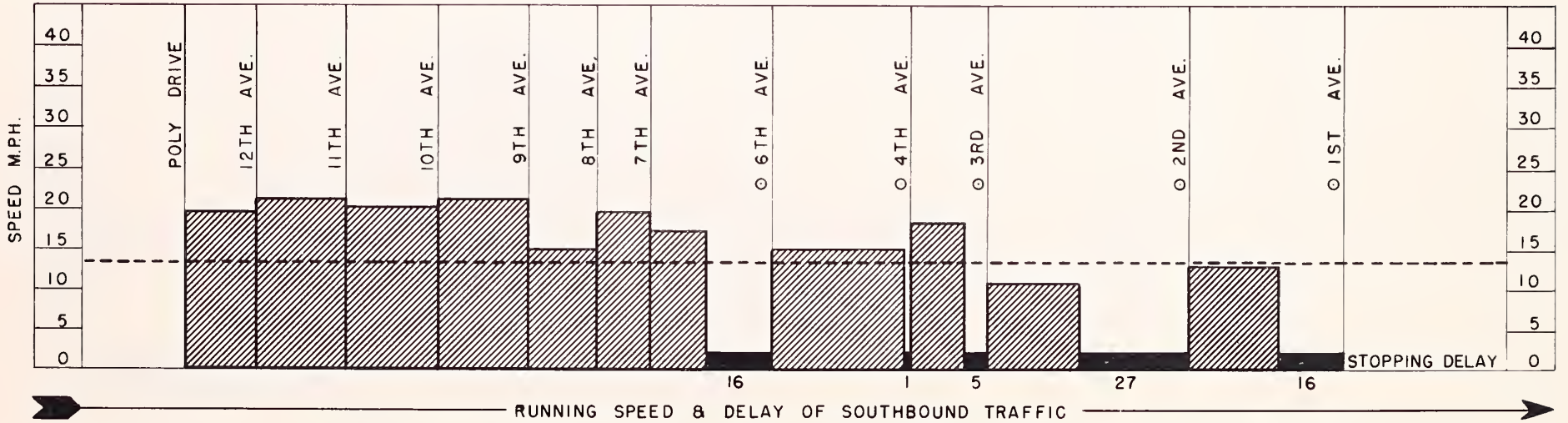
DELAY ANALYSIS



BILLINGS TRAFFIC SURVEY
PEAK HOUR SPEED & DELAY
27TH ST. FROM 1ST AVE. NORTH TO POLY DRIVE

1.06 MILES





LEGEND

- AVERAGE RUNNING SPEED
- AVERAGE OVERALL SPEED
- AVERAGE STOPPING DELAY
- 2 NUMBER OF SECONDS
- ⊙ SIGNAL LOCATIONS

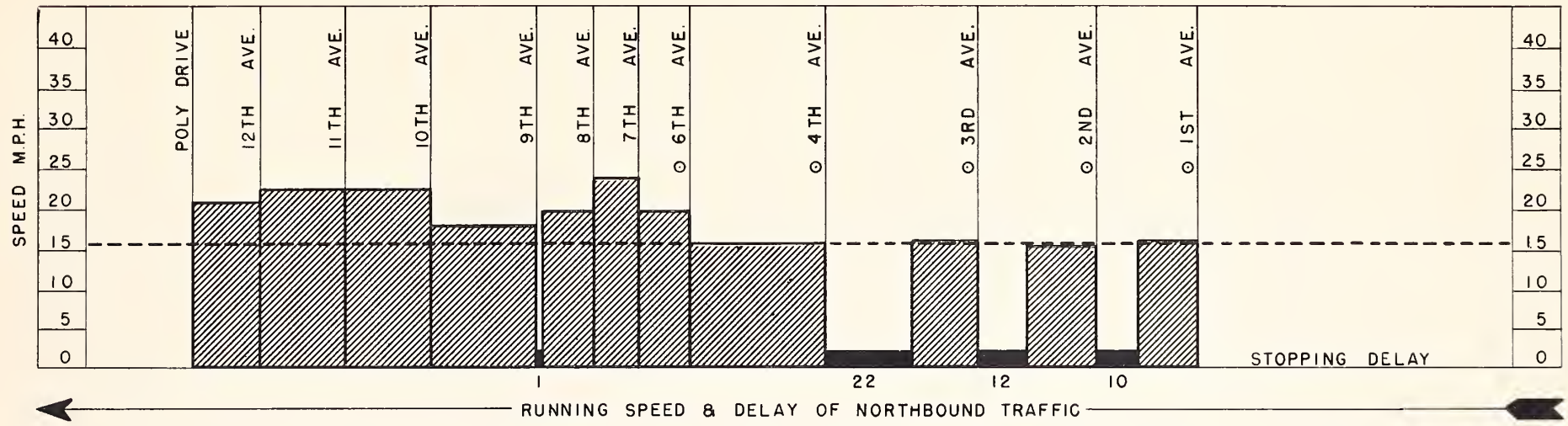
SUMMARY OF PEAK HOUR

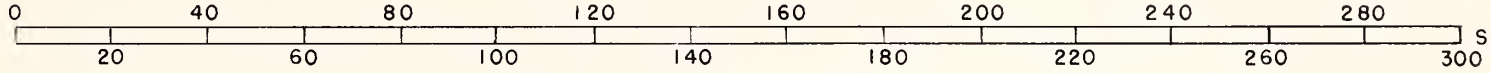
	NORTHBOUND	SOUTHBOUND
TOTAL RUNNING TIME	4 MIN. 27 SEC.	4 MIN. 44 SEC.
TOTAL STOPPING DELAY	52 SEC.	1 MIN 5 SEC.
AVERAGE OVERALL SPEED	14.3 M.P.H.	13.4 M.P.H.

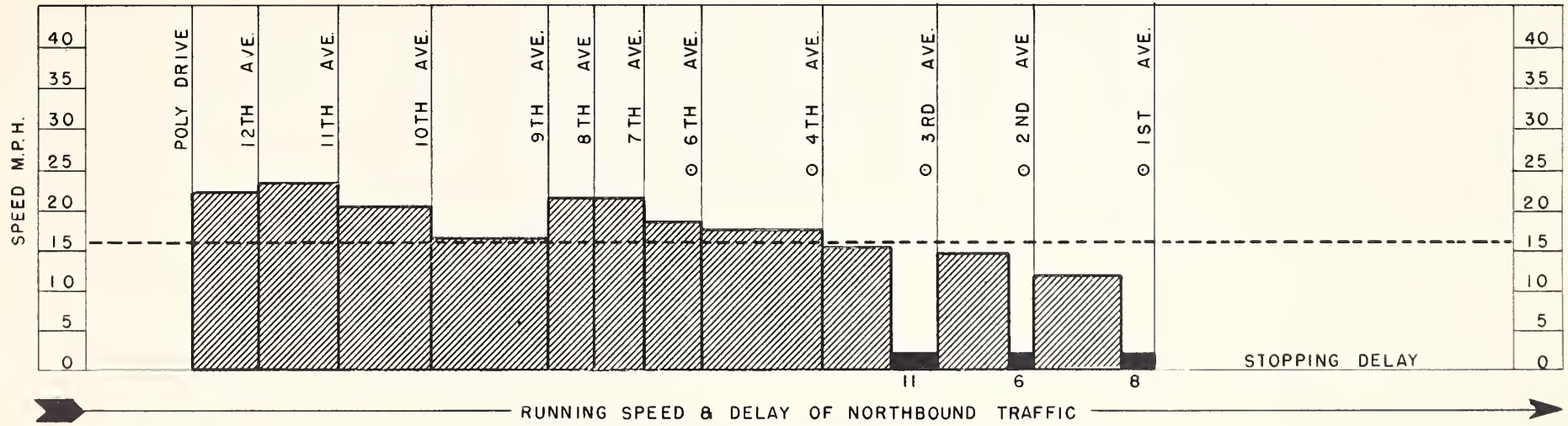
Plate 51

BILLINGS TRAFFIC SURVEY
OFF PEAK HOUR SPEED & DELAY
27TH ST. FROM 1ST AVE. NORTH TO POLY DRIVE

1.06 MILES







LEGEND

- AVERAGE RUNNING SPEED
- AVERAGE OVERAGE SPEED
- AVERAGE STOPPING DELAY
- 2 NUMBER OF SECONDS
- ⊙ SIGNAL LOCATIONS

SUMMARY OFF PEAK HOUR

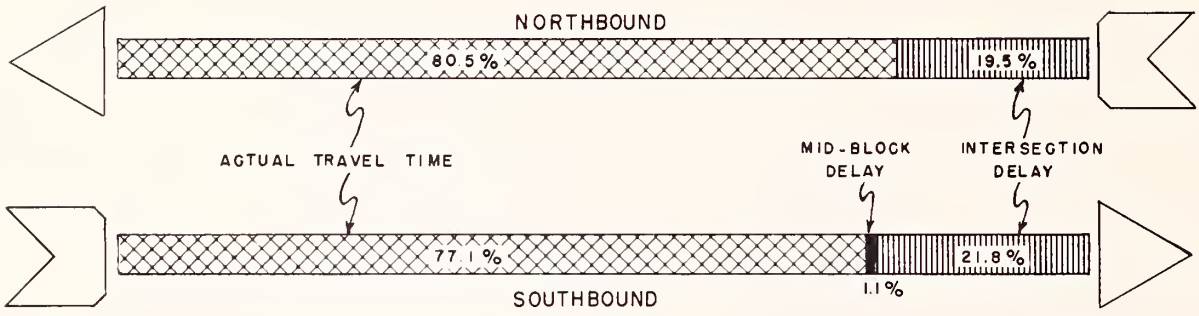
	NORTHBOUND	SOUTHBOUND
TOTAL RUNNING TIME	4 MIN 9 SEC	3 MIN. 57 SEC
TOTAL STOPPING DELAY	45 SEC.	25 SEC
AVERAGE OVERALL SPEED	15.3 M.P.H.	16.1 M.P.H.

Plate 52

BILLINGS TRAFFIC SURVEY
PEAK HOUR - DELAY ANALYSIS
27TH ST. FROM 1ST AVE. N. TO POLY DRIVE

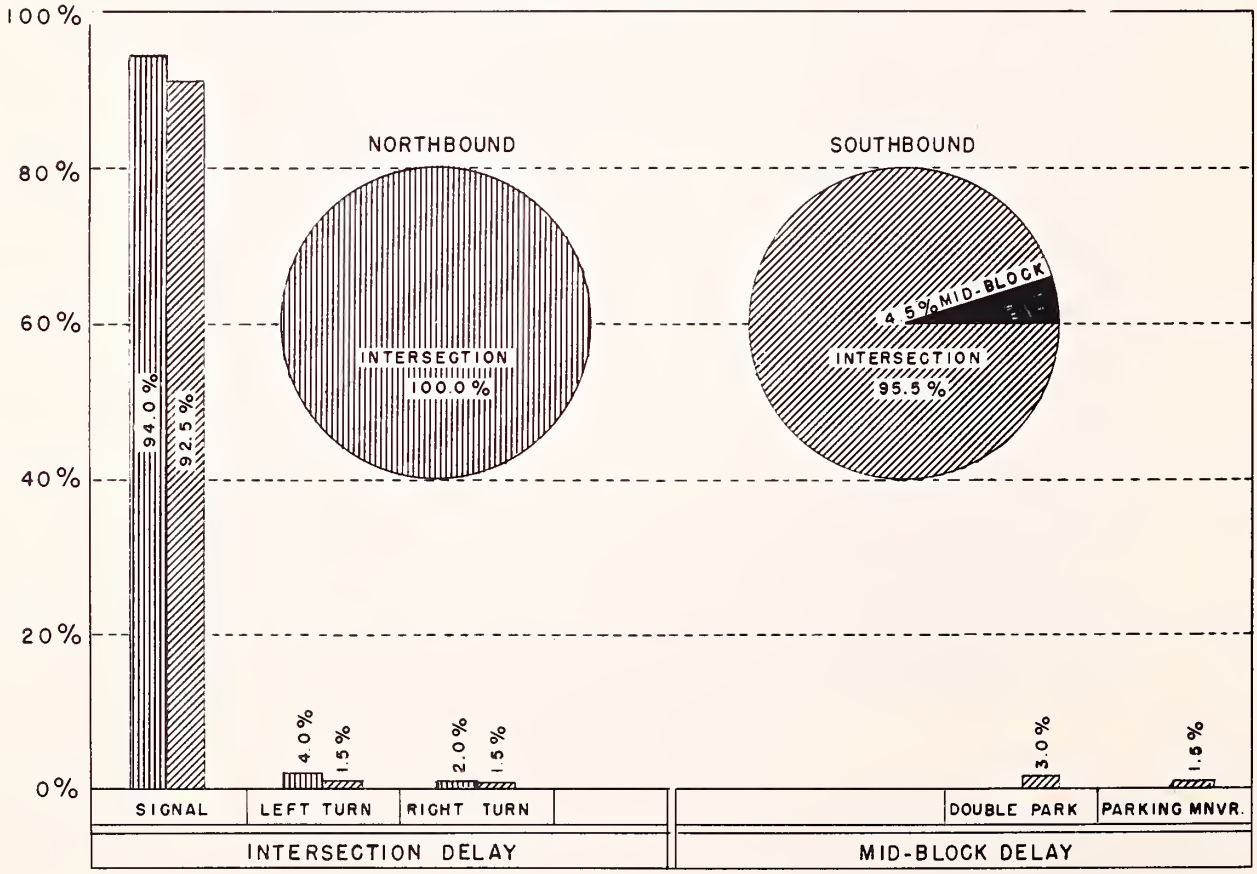
1.06 MILES

PER CENT OF OVERALL TIME

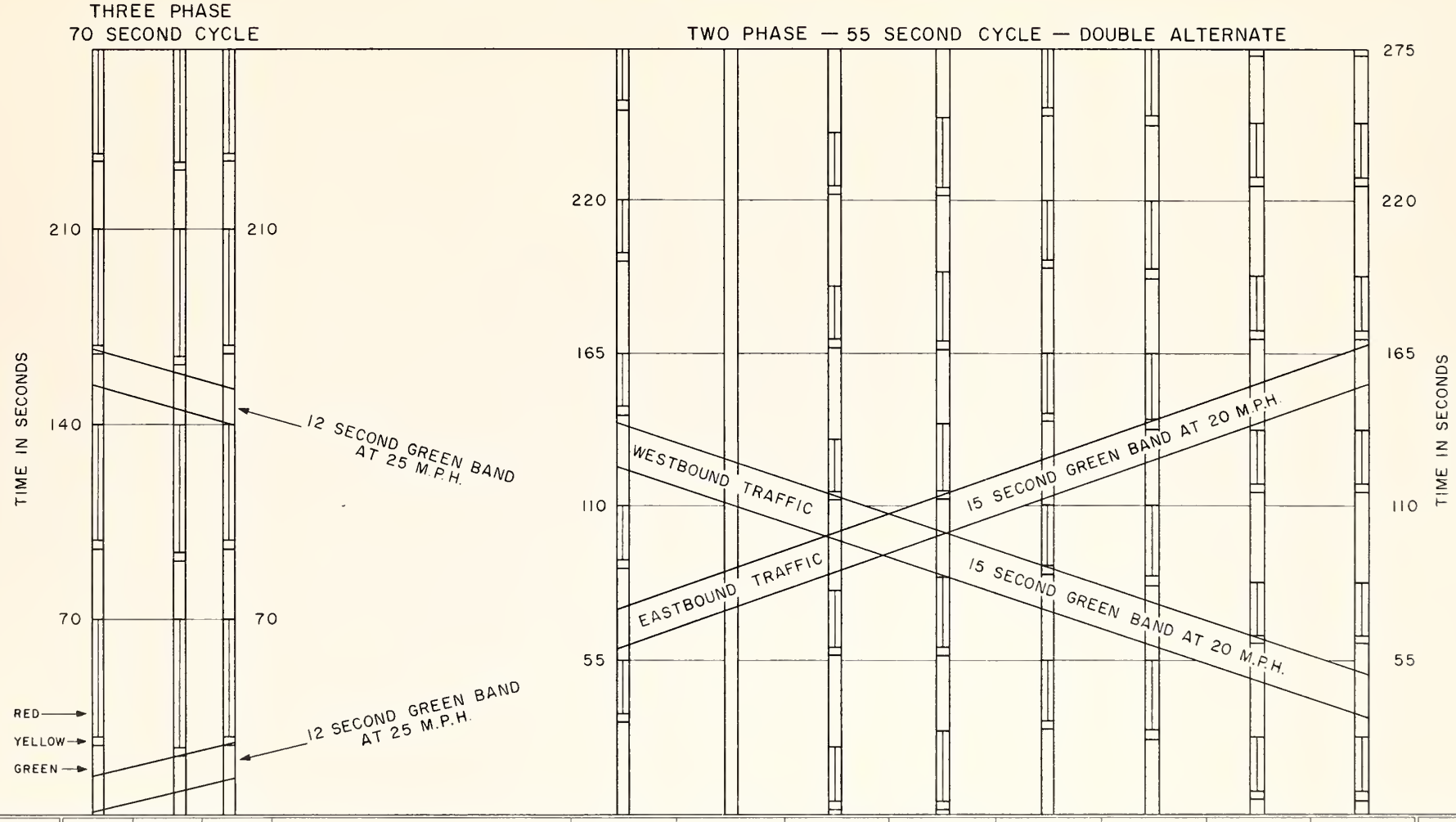


	PEAK HOUR		OFF PEAK HOUR	
	NORTHBOUND	SOUTHBOUND	NORTHBOUND	SOUTHBOUND
AVERAGE OVERALL TIME	4 MIN 27 SEC.	4 MIN. 44 SEC.	4 MIN. 9 SEC	3 MIN. 57 SEC.
AVERAGE OVERALL SPEED	14.3 M.P.H	13.4 M.P.H	15.3 M.P.H.	16.1 M.P.H.
AVERAGE TRAVELING SPEED	17.8 M.P.H.	17.4 M.P.H.	18.7 M.P.H.	18.0 M.P.H.

DELAY ANALYSIS



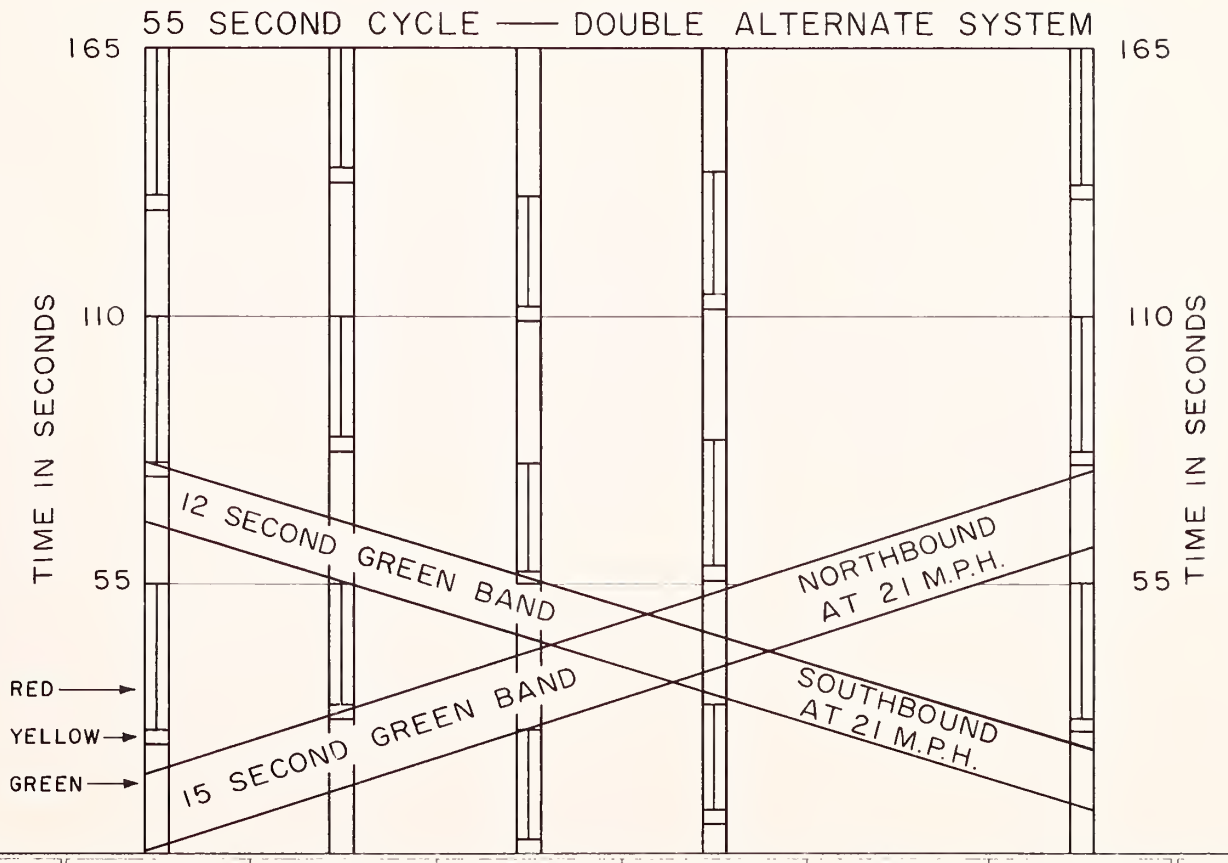
BILLINGS TRAFFIC SURVEY
PROPOSED SIGNAL TIMING
U.S. 10 FROM MONTANA AVE. TO 25TH. ST.



CROSS STREET	MONT.	BRDWTR.	OIVISION		32ND. ST.	31ST. ST.	30TH. ST.	29TH. ST.	28TH. ST.	27TH. ST.	26TH. ST.	25TH. ST.	CROSS STREET
TRAFFIC CONTROL	SIGNAL	SIGNAL	SIGNAL		SIGNAL		SIGNAL	SIGNAL	SIGNAL	SIGNAL	SIGNAL	SIGNAL	TRAFFIC CONTROL
ACCUM. DISTANCE	0'	290'	465'		1885'		2645'	3025'	3405'	3785'	4165'	4545'	ACCUM. DISTANCE
CYCLE SPLIT	35-65 %	30-70 %	35-65 %		65-35 %		65-35 %	55-45 %	60-40 %	55-45 %	65-35 %	65-35 %	CYCLE SPLIT
U.S. 10 GREEN	25 SEC.	21 SEC.	25 SEC.		33 SECONDS		33 SECONDS	27 SECONDS	30 SECONDS	27 SECONDS	33 SECONDS	33 SECONDS	U.S. 10 GREEN
U.S. 10 YELLOW	3 "	3 "	3 "		3 "		3 "	3 "	3 "	3 "	3 "	3 "	U.S. 10 YELLOW
U.S. 10 RED	42 "	46 "	42 "		19 "		19 "	25 "	22 "	25 "	19 "	19 "	U.S. 10 RED
CYCLE LENGTH	70 "	70 "	70 "		55 "		55 "	55 "	55 "	55 "	55 "	55 "	CYCLE LENGTH
GREEN OFFSET	0 "	0 "	0 "		0 "		24 "	29 "	0 "	0 "	27 "	27 "	GREEN OFFSET

Plate 54

BILLINGS TRAFFIC SURVEY
PROPOSED SIGNAL TIMING
27TH. STREET – FROM 1ST. AVE. N. TO 6TH. AVE. N.



CROSS STREET	1ST. AVE. N.	2ND. AVE. N.	3RD. AVE. N.	4TH. AVE. N.	N.P. RY.	6TH. AVE. N.	CROSS STREET
TRAFFIC CONTROL	SIGNAL	SIGNAL	SIGNAL	SIGNAL		SIGNAL	TRAFFIC CONTROL
ACCUM. DISTANCE	0'	380'	760'	1140'		1900'	ACCUM. DISTANCE
CYCLE SPLIT	45–55 %	55–45 %	60–40 %	55–45 %		50–50 %	CYCLE SPLIT
27TH. GREEN	22 SECONDS	27 SECONDS	30 SECONDS	27 SECONDS		25 SECONDS	27TH. GREEN
27TH. YELLOW	3 "	3 "	3 "	3 "		3 "	27TH. YELLOW
27TH. RED	30 "	25 "	22 "	25 "		27 "	27TH. RED
CYCLE LENGTH	55 "	55 "	55 "	55 "		55 "	CYCLE LENGTH
GREEN OFFSET	0 "	0 "	25 "	30 "		0 "	GREEN OFFSET

Plate 55